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GENERAL DESCRIPTION

NOTE: For information pertaining to the Fleetwood Eldorado, refer to the latter portion of the appropriate subsection.

A four link rear suspension system, consisting of two upper and two lower control links, steel coil springs, and shock absorbers, Fig. 4-1, is used on all conventional drive 1969 cars except the Commercial Chassis. The heavier Commercial Chassis uses semi-elliptical multiple leaf rear springs.

On cars except the Commercial Chassis, the rear steel coil springs are placed on brackets on the rear axle housing at the lower ends, and the upper ends are seated in the frame cross member, Fig. 4-1. With this design there are no spring loads acting directly on the suspension bushings. This provides good bushing isolation qualities. Spring insulators are used at both ends of the rear chassis springs to minimize noise.

Two upper control links are attached at their rear ends to inboard brackets on the rear axle housing and at their front ends to brackets just

forward of the rear suspension cross member on the frame side rails. Two lower control links are attached at their rear ends to outboard brackets on the rear axle housing and on their front end, to brackets on the frame side rails. The angles of the upper control links from the center of the axle outward, and of the lower control links from the ends of the axle inward provide good lateral stability.

Oversize bushings are provided at all eight suspension attaching points to give maximum noise isolation. The upper and lower link bushings are the same size but are not interchangeable in application as different rubber specifications are required for these two locations.

The rear shock absorbers are mounted at their upper ends in frame brackets to the rear of the axle center line. The lower ends are attached to the lower control link mounting brackets on the axle housing.

The same type of shock absorbers are used on all cars except cars equipped with Automatic

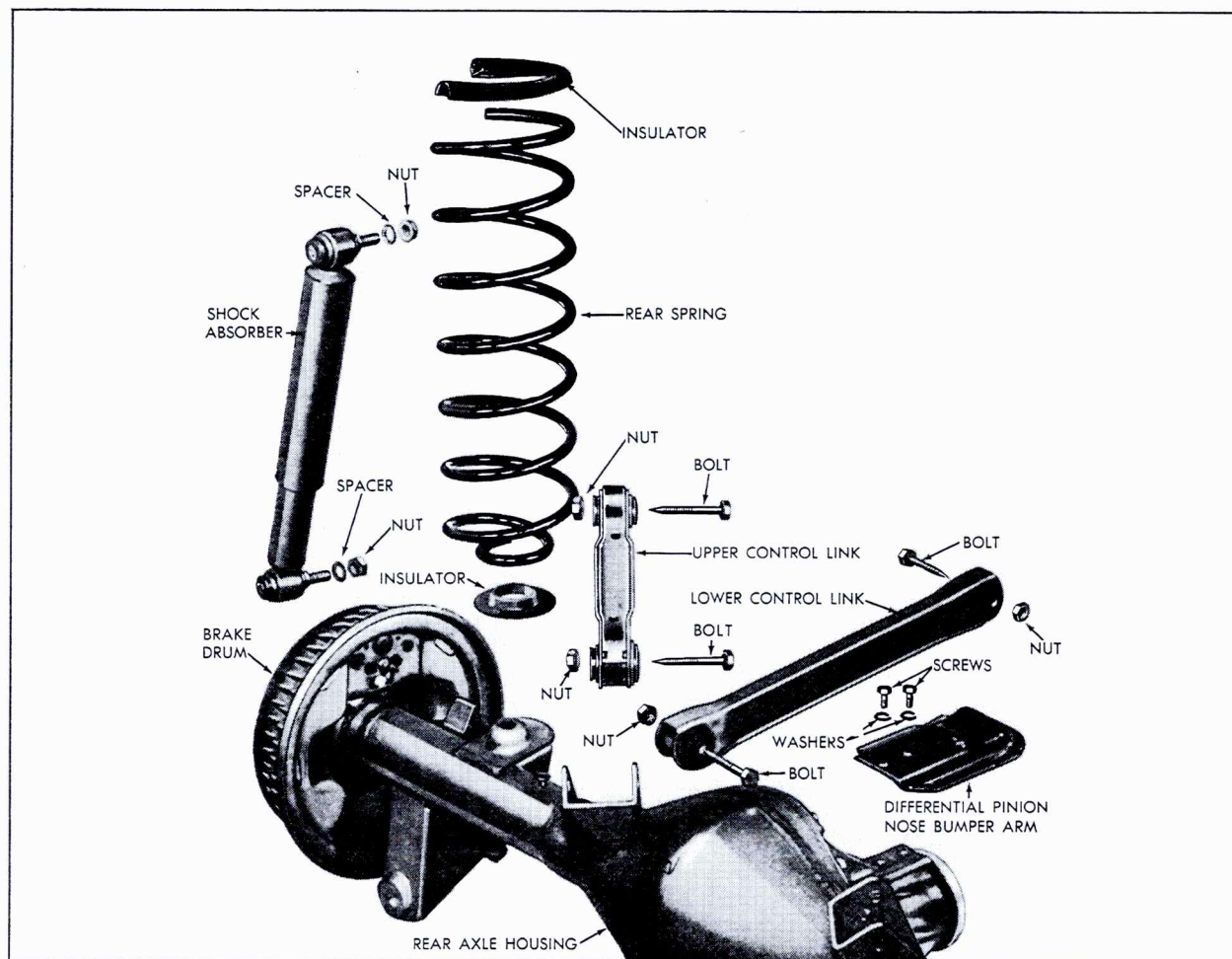


Fig. 4-1 Rear Suspension Disassembled

Level Control. In this case, Superlift shock absorbers are used on the rear suspension system. Individual valving is provided for the Commercial Chassis.

Rear Suspension System (Commercial Chassis Only)

The rear springs are of the semi-elliptical multiple leaf type. They have seven leaves, 2-1/2 inches wide with zinc inner liners between the first four leaves to provide correct interleaf friction and prevent corrosion. Tip liners are provided at the spring end to quiet the spring and further reduce friction. The spring eyes are cushioned at each end by rubber bushings and at the spring seats on the axle housing by rubber insulating pads.

Direct acting type rear shock absorbers are connected at the bottom to the rear spring U-bolt plates and at the top to brackets welded to the rear suspension frame cross member. This type rear shock absorber mounting provides minimum transverse roll along with dampening of road shocks.

Automatic Level Control

a. System (Fig. 4-2)

Automatic pneumatic leveling is provided as standard equipment on the Fleetwood Eldorado, Fleetwood Sixty Special Sedan and Brougham, and the Fleetwood Seventy-Five Sedan and Limousine, and optional on all other models. The system consists of an air compressor and tank assembly, pressure regulator, control valve and link, two superlift rear shock absorbers and flexible air lines.

As load is added, the Superlifts inflate and extend, raising the car to its initial level. As load is removed Superlifts deflate and retract, lowering the car to its initial level. After com-

pletion of work on this system, or when servicing other parts of the car and the system is discharged, charge the reservoir to 140 psi or maximum pressure available, by applying dry air through the compressor service valve located on the pressure regulator.

b. Compressor and Reservoir

The compressor operates on the difference between (1) engine manifold vacuum, supplied to the compressor by a line connected to the crankcase ventilator valve vacuum line, and (2) a higher pressure air at or near atmospheric pressure, available through an air supply line at the air cleaner.

The compressor supplies high pressure air to the reservoir. The compressor is a two-stage type, designed to operate intermittently to replenish air used from the reservoir. It requires no lubrication. As the compressor cycles, the reservoir air pressure gradually increases, causing a back pressure on the second stage piston until it equals the push of atmospheric pressure against the diaphragm. At this point, a balanced condition is reached and the unit stops operating. After reservoir pressure drops due to system air usage, the compressor again begins to cycle and replenish the reservoir.

Balance pressure will depend upon the prevailing manifold vacuum at the carburetor insulator and prevailing atmospheric pressure. Both are affected by altitude above or below sea level. Balance pressure will vary from approximately 150 psi to 275 psi.

c. Pressure Regulator

A pressure regulator is attached to the output side of the reservoir. It regulates Superlift supply pressure to approximately 125 psi.

d. Control Valve and Link

The rear standing height is automatically maintained at a nearly constant position by a control

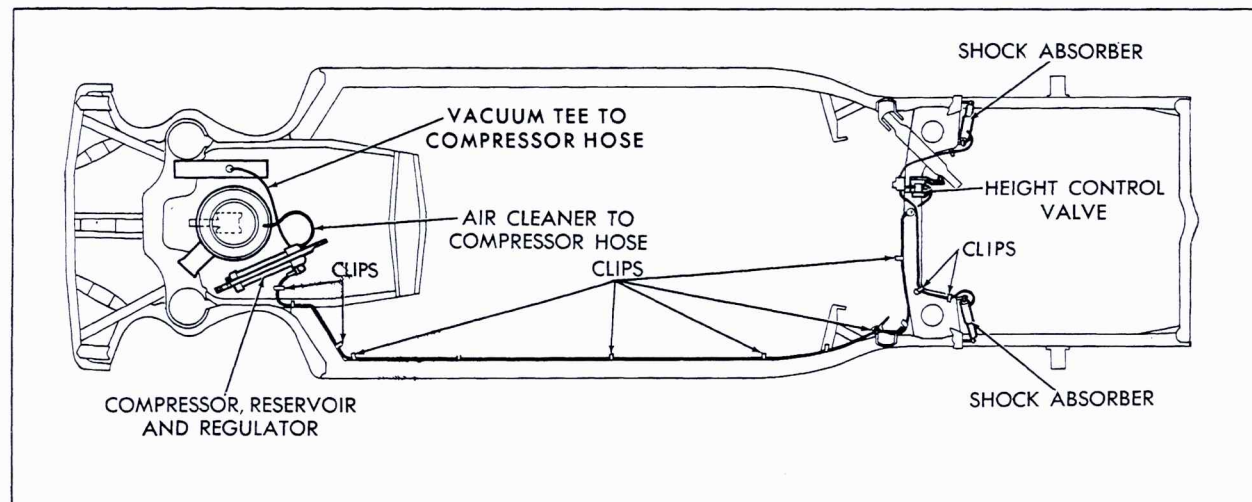


Fig. 4-2 Automatic Level Control

valve attached to the rear suspension cross member. A link attaches the valve lever to the right-hand upper control link. When sufficient load is added to deflect the rear suspension at least 1/2 inch, the control valve admits air to the Superlifts, which then raise the car to level. When load is removed, and the car rises, the control valve exhausts air from the Superlifts, which lower the car to level. A four to eighteen second time delay mechanism inside the control valve housing prevents transfer of air when the lever is moved during normal ride motions. In this manner the control valve responds only to actual load changes of sufficient duration to overcome the delay action.

e. Superlift Rear Shock Absorber (Fig. 4-3)

The Superlift is essentially a conventional shock absorber enclosed in an air chamber. A pliable nylon reinforced neoprene boot seals the dust tube (air dome) to the reservoir tube (air piston). The unit will extend when inflated and retract when deflated by the control valve. The units are connected to the control valve by a common flexible air line which equalizes the air pressure in the two Superlifts.

An eight to fifteen psi air pressure is maintained in the Superlift at all times to minimize boot friction. This is provided by a check valve in the exhaust fitting on the control valve.

f. Lines and Fittings

Flexible air lines of 1/8 inch diameter tubing are used throughout the system. Each fitting consists of a rubber seal, metal sleeve and nut. These parts are designed specifically for the 1/8 inch diameter line and must be used to effect a reliable seal.

While the lines are flexible for easy routing and handling, care should be taken not to kink them and to keep them from coming in contact with the exhaust system.

g. Dealer Installation

As a dealer-installed option, the Automatic Level Control system may be installed either by

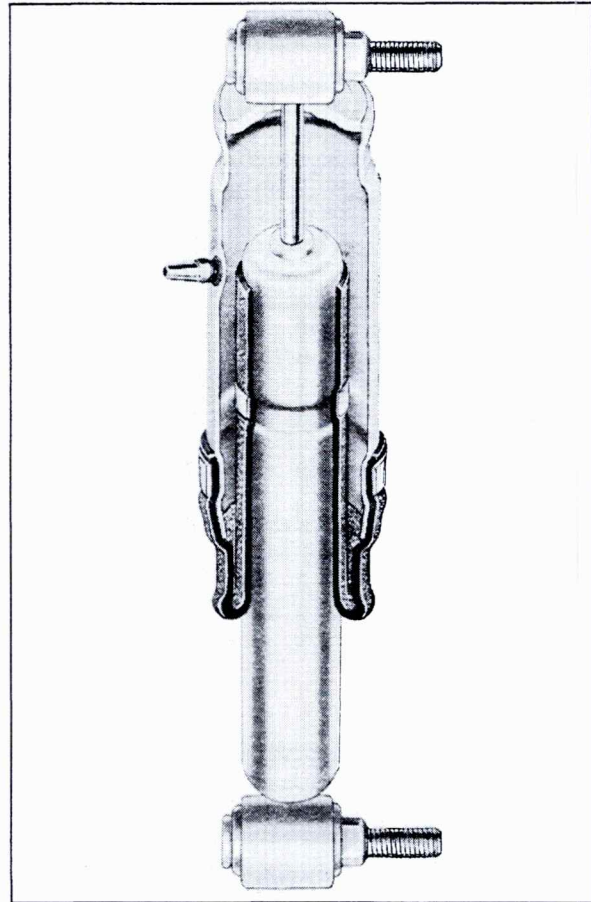


Fig. 4-3 Superlift Shock Absorber

retaining standard suspension springs or by changing to the option spring, as the customer desires.

The standard spring will provide approximately 150 lbs. additional load carrying capacity, but will have a firmer ride and will trim at the same height as cars without the level system.

The special Automatic Level Control spring installed at the factory, and available in service, provides a softer ride and lower rear trim height while maintaining the level conditions for average passenger and trunk loads.

SERVICE INFORMATION

NOTE: For service information pertaining to the Fleetwood Eldorado, refer to the latter portion of the appropriate subsection.

1. Checking Rear Standing Height

Before checking standing (spring) height, make sure that trunk is empty except for spare tire and jack and that there is a full tank of gasoline, as all specifications are based on this observed weight. If car is equipped with Automatic Level Control, deflate system using service valve, then disconnect air line from Superlift port on control

valve. Deflation of the system is necessary when determining the standing height on the basis of springs alone. When checking standing height to determine the proper functioning and adjustment of the Automatic Level Height Control Valve, the system must be connected and the reservoir charged with 100-140 psi. Normalize position of springs by bouncing bumper up and down; gradually release bumper and permit car to assume its normal position.

CAUTION: If any mispositioning, incorrect assembly, or failure of components in the area of the brake system pipes, hoses, or cylinders

is observed, be sure to check for any brake damage that may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly or failure include the exhaust system, shock absorber, springs, suspension control arms, stabilizer bar, power steering pump hoses and transmission cooler pipes.

a. Rear Springs

Measure distance from top of rear axle housing straight up to lower underside surface of frame, Fig. 4-4. Rear standing heights should be equal within 1/2 inch on both sides of car. If heights are unequal, spring that checks below specifications must be replaced. See page 4-17 for specifications for each series.

b. Ride Complaints

In case of hard riding, the first items to investigate are correct tire pressure, correct standing heights, and correct shock absorbers for the car. If these are correct, the amount of friction in the rear suspension system should be checked.

The procedure for checking excessive friction in the rear suspension is as follows:

1. Disconnect rear shock absorbers.
2. With aid of a helper, lift up on the rear bumper and raise the end of the car as high as possible. Slowly release the bumper and allow the car to assume normal standing height. Measure distance from floor to center of bumper. Then push down on bumper, release slowly, and allow car to assume normal standing height. Measure distance from floor to center of bumper.
3. The difference between the two measurements should be less than 1/2 inch. If the difference exceeds the limit, inspect the upper and

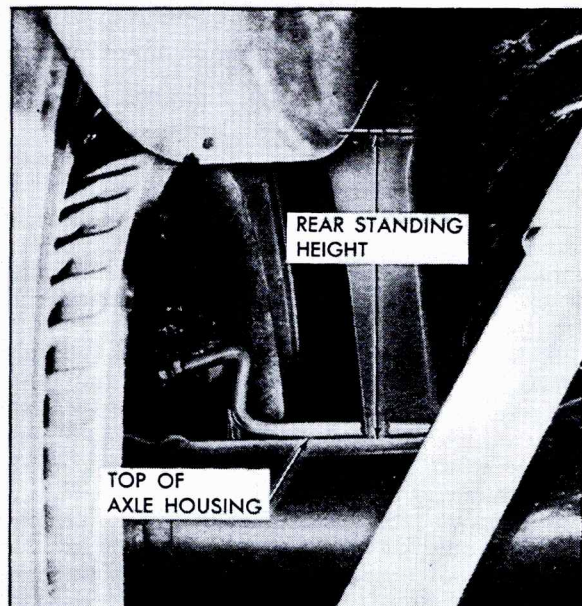


Fig. 4-4 Measuring Rear Standing Height

lower control links for damaged or worn parts.

2. Rear Shock Absorbers

a. Removal

1. Raise rear end of car and place jack stands under axle housing.

CAUTION: The shock absorbers act as rebound stops for the rear suspension. Under no circumstances should rear end of car ever be raised so that rear suspension is in rebound position while disconnecting shock absorber.

2. If removing rear shock absorbers, remove rear brake hose from rear brake line and frame bracket to prevent damage to brake hose.

3. If car is equipped with Automatic Level Control, remove the air line fittings at shock absorbers.

4. Remove shock absorber upper retaining nut. It will be necessary to hold the stem next to the rubber grommet with one wrench to prevent it from turning, while removing retaining nut with a second wrench. Remove shock absorber lower retaining nut and spacer, holding stem in same manner.

NOTE: Be careful not to damage brake piping on axle housing throughout procedure.

5. Remove shock absorber from its mounts.

b. Installation

1. Guide upper and lower shock absorber stems into mounts.

2. Install upper retaining nut. It will be necessary to hold the stem next to the rubber grommet with one wrench to prevent it from turning while installing retaining nut with a second wrench.

3. Install shock absorber lower spacer and retaining nut, holding stem in same manner.

4. Install rear brake hose and bleed brakes.

5. If car is equipped with Automatic Level Control, install air line fittings at shock absorbers, tightening tube nuts to 30-40 inch pounds. Inflate reservoir through service valve to 140 psi or maximum pressure available using dry air.

3. Checking Rear Shock Absorbers

a. On Car Checks

1. Raise car on hoist.
2. Check for correct mounting of shock absorbers. If properly mounted, continue with next step.
3. Disconnect lower shock mount. Extend shock absorber and check to see if piston rod and seal (top of shock) cover is wet with a fresh film of oil. If oil is detected on rear shock absorber, remove the unit for bench check.

NOTE: This check cannot be made on Superlift shock absorbers.

4. If no oil is detected, pump shock absorber up and down by hand as fast as possible. If a skip is felt at end of stroke, remove absorber for bench check.

5. As another check, completely extend shock absorber and pull hard. If spring tension is felt, shock absorber should be replaced.

IMPORTANT: Pumping shock absorber by hand will not fully determine whether a shock absorber is good or bad. The best test method is to compare the questionable shock absorber with its mate on opposite side of car; that is, a front with the other front, and rear with the other rear. If both shocks feel the same, it is unlikely that a shock absorber replacement is necessary. Bad shocks as detected by this test, will affect ride motion only.

b. On Bench Checks (Standard Shock Absorbers)

1. When performing a bench check for any suspected shock absorber, clamp shock absorber upside down in a vise.

NOTE: Cadillac standard shock absorbers can be turned upside down because all internal vapor (inert gas instead of air) is contained in a pliacell envelope which prevents aeration of oil and prevents lag.

2. Pump shock absorber by hand at various rates of speed to find if shock absorber is defective. If a skip is felt at full extension when the shock is inverted, this is normal. A skip on reversal of direction in mid-travel indicates a ruptured pliacell envelope. If smooth resistance is felt throughout length of the stroke, however, the shock absorber need not be replaced. A faint hiss ("orifice swish") is considered normal, but a gurgling noise denotes air bubbles in the fluid, and the shock absorber should be replaced.

c. On Bench Checks (Superlift Shock Absorbers)

1. Clamp lower mounting ring in vise in vertical position with air dome up.

2. Extend and collapse shock completely several times to discharge air out of the working chamber.

3. Pump unit by hand at different rates of speed. Smooth resistance should be felt throughout the length of the stroke. Since the Superlift is normally pressurized, the sound of air bubbles or a gurgling noise is not abnormal.

4. Rear Spring

a. Removal

1. Raise rear end of car. Place hydraulic jack under differential and jack stands under frame side rails, and remove wheel from side of car where spring is to be removed.

2. If car is equipped with Automatic Level Control, disconnect link at overtravel lever by removing nut and lockwasher. Position overtravel lever in center position.

3. Remove shock absorber lower retaining nut and washer and stem from mount on side where spring is to be removed. It will be necessary to

hold the stem next to the rubber grommet with one wrench to prevent the stem from turning, while removing retaining nut with a second wrench.

NOTE: Be careful not to damage brake piping on axle housing, now, and throughout procedure.

4. Remove rear bolt from upper control link on side of car where spring is to be removed. Free rear upper control link from mounting.

NOTE: It may be necessary to place a second jack by the differential carrier nose to facilitate removal of bolt.

5. If removing right rear spring, disconnect brake line hose at bracket on rear suspension cross member. Remove clip that retains hose to bracket and separate hose from bracket. Also remove one screw that secures parking brake cable strap.

6. Remove jack at differential carrier pinion nose and slowly lower second jack from differential.

7. Place jack under side of rear lower control link mount opposite that of the spring being removed.

8. Raise jack until spring can be removed from mount. Inspect lower and upper rubber insulators. Replace if necessary.

b. Installation

1. Make certain frame side rails are supported on jack stands and side opposite spring being installed is in compression position.

2. Position lower rubber insulator on rear axle housing mount.

3. Tape upper rubber insulator to top of spring and position spring so that end of top of spring is properly aligned with recess in upper seat of frame tower.

4. Seat bottom of spring on lower rubber insulator.

5. Lower jack and place under differential housing. Raise jack and check spring position.

6. Install lower shock absorber stem in mount and secure with washer and retaining nut.

7. Position jack under differential carrier to take up load. Use a second jack under differential carrier pinion nose to permit positioning of upper control link in its mount. Install bolt and start the nut.

8. If right rear spring was installed, connect brake line hose loosely at bracket on rear suspension cross member. Install clip that secures hose to bracket and tighten fitting. Bleed brakes as described in Section 5, Note 10 and install screw securing parking brake cable clamp.

9. Remove jack stands and lower car. The car is now at standing height.

10. Tighten upper control link bolt to 90 foot-pounds.

NOTE: Pivot bolt in control link must be

torqued at standing height. If it is not, the ride rate will be affected.

11. If car is equipped with Automatic Level Control, secure link to overtravel lever with attaching nut and lockwasher. Inflate reservoir to 140 psi or maximum pressure available through compressor service valve.

5. Rear Lower Control Link

a. Removal (Fig. 4-5)

1. Raise rear end of car and place on jack stands.

2. If car is equipped with Automatic Level Control, disconnect link at overtravel lever by removing nut and lockwasher. Position overtravel lever in center position.

3. Remove front and rear lower control link nuts.

NOTE: Be careful not to damage brake piping on axle housing, now, and throughout procedure.

4. Place jack under front of differential to relieve tension on lower link bolts.

5. Remove front and rear lower control link bolts and link.

NOTE: The front and rear bushings in the lower control links are not serviceable. These bushings are the same size as the upper control link bushings but are not interchangeable as the rubber has different characteristics. The wrong bushing may cause poor handling or increased axle noise.

b. Installation

1. Slide lower control link into position with the flange of the bushing inboard, and install two bolts from inboard side. Adjust jack under front of differential as necessary to install bolts.

2. Loosely install nuts on bolts.

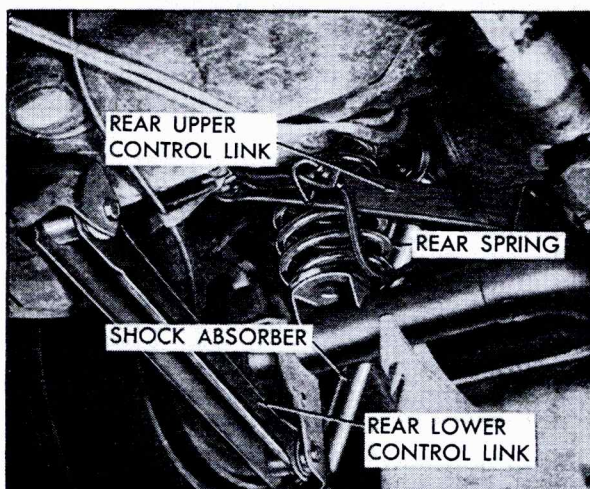


Fig. 4-5 Rear Suspension

3. Remove jack stands and lower car. The car is now at standing height.

4. With car at standing height, tighten front and rear lower control link nuts to 90 foot-pounds.

NOTE: Pivot bolts in control links must always be torqued at standing height. If they are not, the ride rate will be affected.

5. If car is equipped with Automatic Level Control, secure link to overtravel lever with attaching nut and lockwasher. Inflate reservoir to 140 psi or maximum pressure available through compressor service valve.

6. Rear Upper Control Link

a. Removal

1. Raise rear end of car, and place on jack stands.

2. If car is equipped with Automatic Level Control, remove attaching nut that secures Height Control Valve link to right hand upper control link, Fig. 4-14. Position overtravel lever in center position.

3. Working at front of link to be removed, mark floor pan with a punch, in line with center of bolt head.

NOTE: Be careful not to damage brake piping on axle housing, now, and throughout procedure.

4. Remove rear cushion and seat back.

5. Drill 1-1/4 inch hole in floor pan, using mark on floor pan as center of hole.

NOTE: Use only 1-1/4 inch drill as plug used during assembly is designed to fit this size.

6. Place jack under differential housing and raise jack to relieve tension on upper control link.

7. Remove rear pivot bolt.

8. Remove forward pivot bolt, and guide the bolt through hole in floor pan. Remove upper control link.

NOTE: The front and rear bushings in the upper control links are serviceable and can be removed and installed by using an arbor press. These bushings are the same size as the lower control link bushings but are not interchangeable with them, as they have different rubber characteristics.

b. Installation

1. Install arm with flanged surfaces of bushing inboard.

2. Loosely install front pivot bolt after first guiding the bolt through floor pan.

3. Loosely install rear pivot bolt in upper hole of bracket. Adjust jack under front of differential as necessary to install bolts.

NOTE: The lower hole in axle housing

mounting bracket is a manufacturing hole, and must not be used.

4. Remove jack stands and lower car. The car is now at standing height.

5. Tighten front and rear pivot bolts to 90 foot-pounds.

NOTE: Pivot bolts in control links should be torqued only at standing height. If they are not, the ride rate will be affected.

6. Install a 1964 windshield wiper mechanism access hole plug in floor pan.

7. Replace seat back and cushion.

8. If car is equipped with Automatic Level Control, secure link to right hand upper control link with attaching nut. Inflate reservoir to 140 psi or maximum pressure available through compressor service valve.

7. Rear Leaf Spring Liner Service (Commercial Chassis)

Replacement rear spring liner tips are available for installation between the spring leaves when original liners wear at the outer ends.

To install these replacement liner tips, it is necessary to use a hardwood wedge 2-1/2 inches wide, 5 inches long, and tapered from 1/8 inch to 3/4 inch thick in 2 inches of length. Proceed as follows:

1. Remove spring rebound clips.
2. Raise rear of car until springs are in full rebound position.
3. Mark off length of replacement liner tip on main spring leaf, allowing 1/2 inch projection beyond second leaf.

4. After carefully placing a piece of sheet metal between liner and spring leaf to protect leaf, pry first and second leaf apart and insert wedge under liner just beyond old liner.

NOTE: It is necessary to protect the spring leaf because a small nick in the leaf from a steel wedge could cause a point of fatigue that might result in spring failure. Use a hardwood wedge whenever possible.

5. Remove original liner.
6. Install new liner tip with button end toward axle. Work out wedge, keeping liner tip in position.
7. Repeat above operation at each of the two upper liners in each rear spring.

8. Rear Leaf Spring (Commercial Chassis)

a. Removal

1. Jack up car so that weight of body is entirely off the spring and support axle housing with adjustable stands.

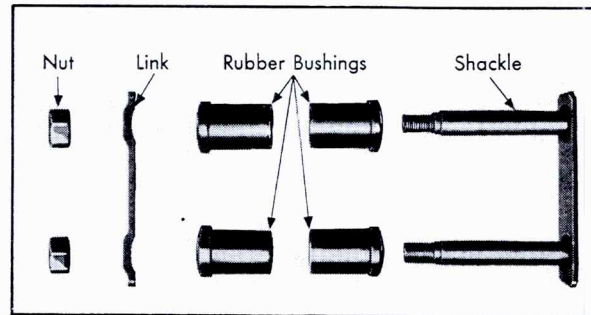


Fig. 4-6 Rear Leaf Spring Shackle

2. Remove front shackle bolt nut and drive out shackle bolt.

3. Disconnect shock absorber from U-bolt plate.

4. Remove rear shackle nuts and link, Fig. 4-6.

5. Remove U-bolt nuts, washers, lower spring plate, lower insulator retainer and insulator pad.

6. Remove spring from rear shackle by removing shackle from frame or by driving spring off shackle.

b. Installation

1. Install new bushings in spring eyes and in shackle-to-frame mounting sleeves.

2. Install shackle on frame.

3. Install spring on lower shackle bolt.

4. Line up front spring eye on bracket on frame and install bolt from inner side of frame. Install nut, but do not tighten until car is lowered.

5. Install shackle link and shackle nuts.

6. Install insulator pad and retainer on top of spring, with hole in pad and retainer over spring center bolt.

7. Position center of spring under rear axle housing bracket with spring center bolt located in hole provided in bracket.

8. Install insulator pad, retainer, and U-bolts; and install U-bolt nuts and lockwasher, torquing to 45 foot-pounds.

NOTE: Lower car before tightening U-bolts or rear shackle nuts. This permits rubber bushings to take a neutral position and assures a more accurate torquing.

9. Connect rear shock absorber at spring U-bolt plate.

10. Tighten front eye bolt and rear shackle nuts to 70 foot-pounds.

9. Tubing

NOTE: Tubing may be removed by simply unscrewing nut. Be sure system is deflated when separating air lines. When installing tubing at any Automatic Level Control fitting, be careful not to kink line.

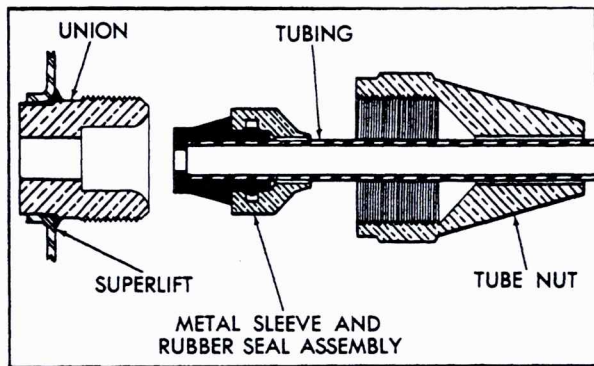


Fig. 4-7 Typical Tubing Fitting

1. Preassemble metal sleeve and rubber seal, Fig. 4-7.
2. Place nut on tubing.
3. Insert tube into metal sleeve and rubber seal until tube bottoms.
4. Holding tubing in bottomed position, tighten tube nut securely (30-40 inch pounds).

NOTE: Tubing may be reinstalled at its connections. If tubing is cracked at end, it will be necessary to cut flush and use a new metal sleeve and rubber seal to assemble connector. Be careful not to remove too much, or tubing may be kinked or broken at full suspension travel. Care should be taken that proper routing is followed in areas close to the exhaust system to prevent burning the tubing. Note particularly the areas at rear suspension cross member, Fig. 4-2.

10. System Test

The source of a system problem is best pinpointed by checking the air supply and control sections separately.

1. Perform the Compressor Output Test On Car, as described in Note 11.
2. If satisfactory, proceed to Control Valve Test, Note 18.

11. Compressor Output Test-On Car

1. With Climate Control off and transmission selector lever in Neutral, run engine until fast idle screw is off fast idle cam. Turn off ignition.
2. Deflate system through service valve. Remove high pressure line at regulator adapter fitting and connect Test Gage, J-22124, Fig. 4-8.
3. Inflate reservoir to 70 psi through service valve.
4. Observe Test Gage for evidence of compressor air leak.
5. If compressor is leaking, proceed to leak test compressor reservoir and regulator as described in Note 20a. If not leaking, continue this test.

6. With engine running at slow idle, observe reservoir build-up for five minutes. Reservoir pressure should build-up to a minimum of 90 psi.

7. If compressor fails to cycle, make sure the vacuum and air intake lines are not reversed and are open and unobstructed before removing compressor for repair. Check for pinched or kinked vacuum hoses. A minimum of 12 inches of vacuum should be available.

8. If build-up is too slow, and a recheck of vacuum and intake hoses show no restrictions, repair compressor as outlined in Notes 13 to 15.

9. Satisfactory pressure build-up indicates compressor is functioning properly. Continue to build up pressure and perform regulator check as described in Note 16.

10. If no leaks are detected and compressor and regulator functions properly, remove test gage. Install high pressure line and proceed to control valve test Note 18.

12. Compressor, Regulator and Reservoir Assembly

a. Removal

1. Raise hood.
2. Remove air intake and vacuum hoses from compressor fittings.
3. Remove high pressure line from regulator fitting.
4. Loosen clamps securing compressor to cowl-to-wheel housing strut, slide clamps away from mounting brackets and remove assembly from car.
5. Remove nuts and lockwashers securing mounting brackets to flexible mounts on compressor assembly and remove mounting brackets.

b. Installation

1. Position mounting brackets to flexible mounts and secure with lockwashers and nuts.
2. Position mounting brackets to cowl-to-wheel

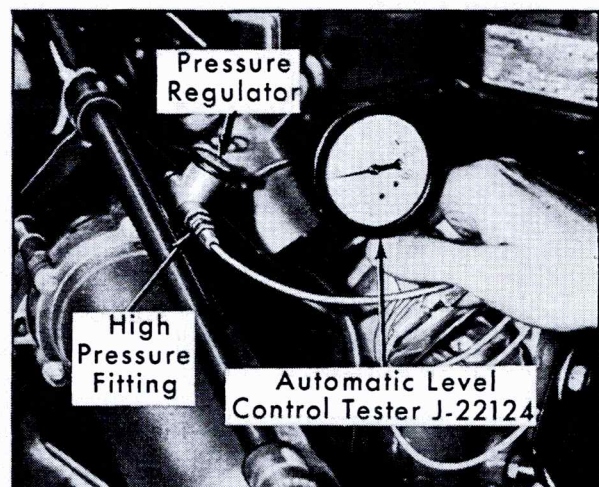


Fig. 4-8 Testing Compressor Output

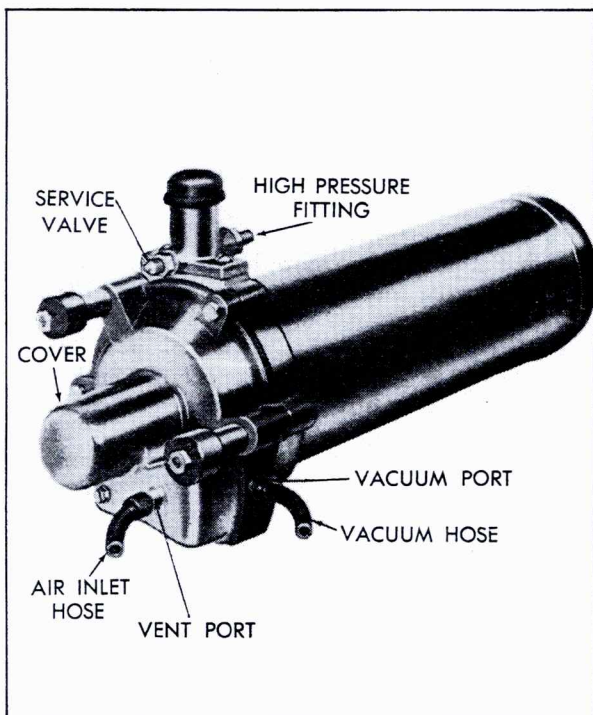


Fig. 4-9 Compressor Hose Locations

housing strut, with compressor end of assembly toward dash, and slide clamps over mounting brackets.

3. Install high pressure line on regulator fitting, following procedure described in Note 9.
4. Install air inlet hose to vent fitting, Fig. 4-9.
5. Install vacuum hose to vacuum fitting.
6. Reposition assembly as necessary, and tighten clamps securing assembly to strut.
7. Inflate reservoir to 140 psi or maximum pressure available through service valve.
8. Lower hood.

13. Disassembling Compressor, Reservoir and Regulator into Major Components (Fig. 4-10)

The compressor is a precision-built mechanism. All parts should be carefully handled and assembled. Take care to prevent entrance of dirt or foreign matter. **DO NOT LUBRICATE** as unit is designed to run dry.

1. Remove compressor as described in Note 12a.
2. Remove three flexible mounts and two adapters.
3. Remove reservoir retaining through bolt, cover retaining screw and cover gasket that secure cover and gasket to first stage housing. Remove cover and discard gasket.
4. Remove two regulator retaining screws, regulator assembly and O-ring from second stage housing. Discard O-ring.
5. Remove three nuts at reservoir flange and two through bolts that enter from flanged side of

reservoir. Separate reservoir and O-ring. Discard O-ring.

6. Remove three compressor retaining through bolts that secure second stage housing to first stage housing.

7. Slide second stage (small diameter) housing straight off piston.

8. Disconnect arm tension spring from swivel arm.

9. Remove arm pivot screw and actuating arm.

10. Slide piston assembly straight out of first stage housing.

14. Compressor, Reservoir and Regulator Disassembly, Inspection and Assembly of Major Components

a. Diaphragm

Inspection

1. Inspect diaphragm for holes, looseness or other defects and replace if necessary.

Disassembly

1. Remove diaphragm retainer with diagonal pliers and discard.
2. Remove diaphragm plate, diaphragm, second diaphragm plate and washer from piston.

Assembly

1. Install new washer, old plate, new diaphragm with outer lip toward second stage side, Fig. 4-10 and second plate. Plates should be installed so that lip on both plates faces outboard from diaphragm.
2. Use a 13/16 inch deep socket as a pilot for the new diaphragm retainer. Press against the piston shoulder on first stage side, Fig. 4-11 to position diaphragm retainer. The wood blocks used are each 3/4 inch x 3/4 inch x 12 inch.

NOTE: Position diaphragm retainer securely to effect air tight seal against washer.

b. Piston Seals

Inspection

1. Inspect seals for evidence of excessive wear or scoring. If necessary, replace seals and O-rings.

Removal

1. Remove seals and O-rings from piston.

Installation

1. Install new O-rings by rolling into groove. Relieve any resulting twist.
2. Install new seals using a piece of .020" shim stock, Fig. 4-12. Make sure shim stock has no sharp edges that may cut seal. Do not stretch seal more than necessary to install. Seals should be installed so they are not twisted.

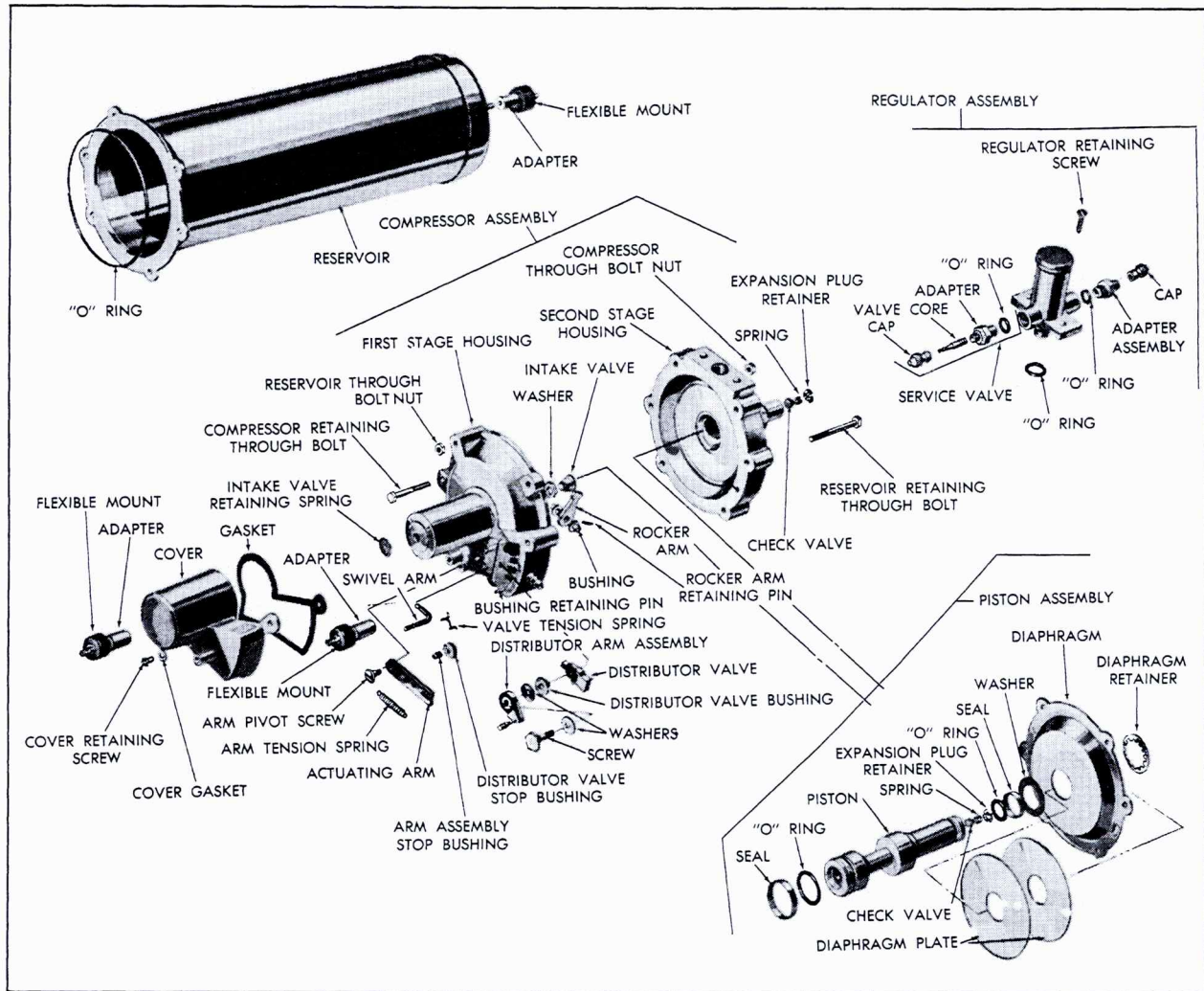


Fig. 4-10 Compressor Assembly Disassembled

c. Distributor Valve Mechanism and Intake Valve (First Stage Housing)

NOTE: Actuate distributor valve with finger.

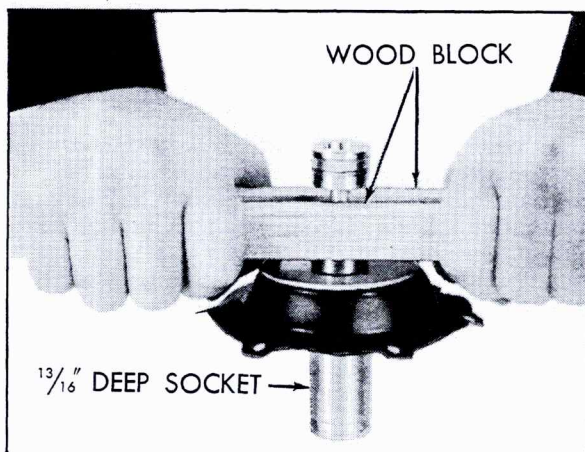


Fig. 4-11 Installing Diaphragm Retainer

Valve tension spring should press against distributor valve, holding it against either stop. If valve action is not free and positive, it will be necessary to rebuild, using new parts in Distributor Valve and Arm Package. If action is free and positive, and inspection upon disassembly shows no damaged parts, parts may be re-used.

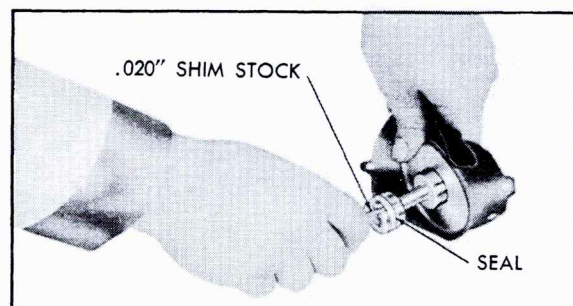


Fig. 4-12 Installing Seal

Disassembly

1. Remove screw, washer, distributor arm assembly, washer, and distributor valve bushing.
2. Remove two arm assembly stop bushings and two distributor valve stop bushings.
3. Remove distributor valve, being careful not to distort valve tension spring.
4. Remove distributor valve tension spring from first stage housing boss, again being careful not to distort valve tension spring.
5. Remove intake valve retaining spring, intake valve and washer, using pocket knife.
6. If necessary, remove rocker and swivel arms. Position pin for removal by prying with screwdriver, Fig. 4-13. Grip pin with water pump pliers and remove pin. Remove swivel arm, rocker arm and bushings.

Cleaning and Inspection

1. Clean all parts in clean solvent except distributor arm assembly and blow dry with compressed air.
2. Inspect distributor valve for cracks. Discard if damaged.
3. Inspect all other parts for wear or damage.

Assembly

1. If removed, position bushings in first stage housing and install rocker arm and swivel arm. Align hole in rocker arm with swivel arm and install rocker arm retaining pin, small end first. Check for clearance of pin to housing.

NOTE: If distributor mechanism failed to function properly or one or more parts were found defective, use new parts in distributor valve and arm package during remaining build-up.

2. Install washer on intake valve and install in first stage housing with intake valve retaining

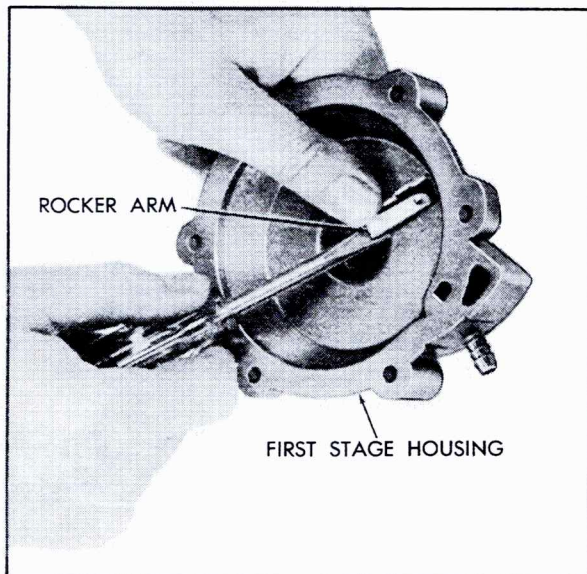


Fig. 4-13 Removing Rocker Arm

spring. Check for proper seating of valve by blowing air from piston side. No air should pass through valve.

3. Install longer leg of valve tension spring into boss on first stage housing, being careful not to distort valve tension spring.

4. Position distributor valve, being careful not to distort valve tension spring.

5. Install two distributor valve stop bushings and two arm assembly stop bushings.

6. Install distributor valve bushing, washer, distributor arm assembly, and washer and secure with screw. Tighten to 12 inch pounds.

NOTE: Do not install remaining parts at this time as rocker arm must be free to permit entrance of piston into first stage housing.

d. Check Valve Replacement (Second Stage Piston)

1. Pry out expansion plug retainer on second stage piston with pointed tool and remove spring and check valve.

2. Pour a small amount of clean solvent through bore in piston and blow dry with compressed air. Check valve seat should be smooth and clean.

3. Install new check valve and spring.

4. Insert new expansion plug retainer and tap in until it bottoms.

NOTE: Check for proper seating of valve by blowing through small end of piston. No air should pass through.

e. Check Valve Replacement (Second Stage Housing)

1. Pry out expansion plug retainer on second stage housing with pointed tool and remove spring and check valve.

2. Clean second stage housing with clean solvent and blow dry with compressed air. Check valve seat should be smooth and clean.

3. Install new check valve and spring.

4. Insert new expansion plug retainer and tap in until it bottoms.

NOTE: Check for proper seating of valve by blowing through small end. No air should pass through.

15. Assembling Compressor Reservoir and Regulator from Major Components

1. Slide piston assembly straight into first stage (large diameter) housing.

2. Install actuating arm and attach to first stage housing with arm pivot screw.

3. Connect arm tension spring to swivel arm.

4. Rotate piston in first stage housing to align elongated hole in diaphragm with vent port in first stage housing.

5. Install three compressor retaining through bolts that secure second stage housing to first stage housing. Housings will align one way only.

Nuts are positioned in counterbores in second stage housing. Tighten to 28 inch-pounds.

NOTE: Check for free operation of valve parts.

6. Install new O-ring on second stage housing. Wash inside of reservoir in clean solvent and blow dry with compressed air. Install reservoir on second stage housing with three nuts, tightening to 28 inch-pounds. Install two reservoir retaining through bolts, tightening to 28 inch-pounds. Through bolt heads should be positioned against reservoir. Do not install through bolt that secures cover at this time.

7. Install new O-ring on regulator and secure regulator with two regulator retaining screws. Tighten to 35 inch-pounds. Service valve should be on same side as second stage housing.

8. Install new gasket and cover, and secure with cover retaining screw and new cover gasket. Tighten cover retaining screw to 35 inch-pounds. Install through bolt with head positioned against reservoir. Tighten through bolt to 28 inch-pounds.

9. Install three adapters and flexible mounts.

10. Proceed to compressor output test on car, Note 11.

11. If compressor passes output test, install as outlined in Note 12b.

16. Regulator Test

Performance test the regulator with a known good compressor on the car.

1. Deflate system through service valve, remove line at regulator and connect Test Gage J-22124 at regulator adapter.

2. Inflate reservoir through service valve to maximum pressure available. If less than 140 psi, start engine to build up reservoir to this pressure.

3. Regulated pressure on the Test Gage should build up to 100-130 psi and hold steady within this pressure.

4. Recheck regulated pressure by momentarily depressing valve core on Test Gage and observe gage reading.

5. If regulated pressure exceeds 130 psi, replace regulator as a unit.

17. Trim Adjustment—On Car

Trim adjustment should be performed with a full fuel tank (or the equivalent in load at the rate of 6 lbs/gallon).

a. Preparation

1. Raise car with rear axle supported.
2. Remove Superlift line at control valve, Fig. 4-14.
3. Connect a Fill Valve Assembly, J-21999 (not illustrated) to this line (male end).
4. Inflate Superlifts to 8-15 psi. Move car up and down to neutralize suspension.

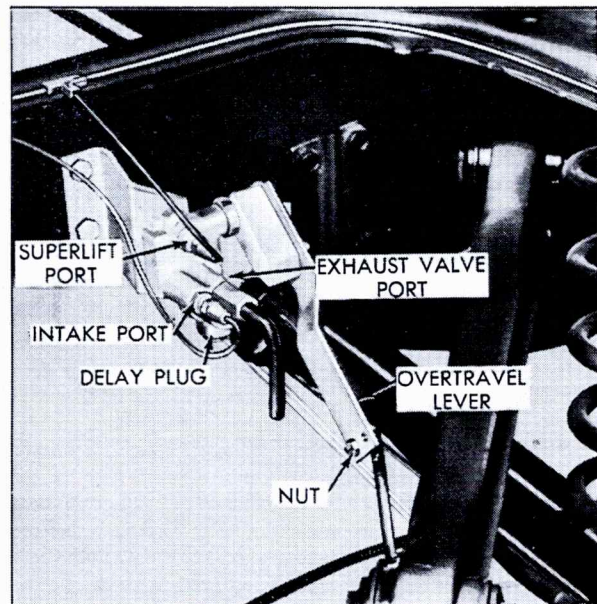


Fig. 4-14 Height Control Valve

5. Connect Test Gage J-22124 to Superlift adapter on control valve and attach air pressure source (80-110 psi).

b. Adjustment

1. Loosen overtravel lever adjusting nut.
2. Hold overtravel body down in exhaust position until air escapes from exhaust valve port.
3. Slowly move overtravel body and tighten nut at the point of minimum air bleed. With nut tight, a slight continuous air bleed will still be noticeable.

c. Restore System

1. Remove Test Gage and air pressure source from Superlift adapter.
2. Remove Fill Valve Assembly, J-21999, from Superlift line and reconnect line to control valve.
3. Lower car and inflate reservoir through service valve.

18. Control Valve Test

NOTE: If tests are performed when car is cold, (15°F or less) time delay may be as much as 30 seconds.

a. Intake (Reservoir Pressure 125 psi Minimum)

1. Disconnect overtravel lever from link.
2. Hold lever up in intake position until Superlifts inflate or for a minimum of 18 seconds.
3. If Superlifts inflate and hold, proceed to Time Delay Check.
4. If Superlifts inflate and then leak down, perform leak test on lines and fittings and then on Superlifts, Note 20d.
5. If Superlifts inflate with the lever in the neutral position, perform leak check on valve.

6. If Superlifts do not inflate, check air source. Also check and, if necessary, replace intake and Superlift screens and O-rings. If Superlifts still do not inflate, perform leak test on valve, Note 20b. Repair as indicated and proceed to time-delay check.

b. Exhaust (Superlifts Inflated)

1. Disconnect overtravel lever from link.
2. Hold lever down in exhaust position until Superlifts deflate or for a minimum of 18 seconds.
3. If Superlifts deflate, perform Intake Check.
4. If Superlifts do not deflate, remove exhaust adapter from control valve and hold lever down as in step 2. Replace adapter, O-ring and filter if this deflates Superlifts.
5. If Superlifts deflate with lever in neutral position, perform leak checks on lines and fittings. If continuous leakage appears at exhaust valve port, leak check control valve, Note 20b.
6. Replace control valve if none of the above steps correct the condition.

c. Time Delay Check

1. Disconnect overtravel lever from link.
 2. Disconnect lines at Superlift and intake ports.
 3. Connect Test Gage J-22124, to intake valve port and open air pressure (95 psi). Move overtravel lever approximately one inch down from neutral position as measured from end of lever, and hold for 15-20 seconds.
 4. Quickly move overtravel lever upward two inches; at the same time begin timing number of seconds before air starts to escape from Superlift port. This delay should be from 4-18 seconds. Repeat check. This will check the air intake time delay. Proceed with check to determine air exhaust time delay.
 5. Remove Test Gage and plug intake port with Fill Valve J-21999 (female end).
 6. Connect Test Gage to Superlift port and open air pressure (95 psi). Move overtravel lever approximately one inch up from neutral position as measured from end of lever, and hold for 15-20 seconds.
 7. Quickly move overtravel lever downward two inches; at the same time begin timing number of seconds until air begins to escape from exhaust port. This delay should be 4-18 seconds. Repeat check.
- If either delay is not within specification, replace the leveling control valve and proceed to Trim Adjustment On Car, Note 17.

19. Height Control Valve

a. Removal

1. Deflate system, using service valve.
2. Disconnect air lines at leveling valve intake and Superlift ports.
3. Disconnect link from overtravel lever by removing one nut and lockwasher.

4. Remove two screws securing leveling valve to frame and remove leveling valve.

b. Installation

1. Install leveling valve with two screws, with time delay mechanism down.
2. Secure link to overtravel lever with one nut and lockwasher. On all convertible series cars, the link is secured to the lower hole. On all other series cars with standard springs, the link is also secured to the lower hole. If the car is not a convertible and has the special springs, the link is secured to the upper unmarked hole.
3. Connect air lines at control valve intake, and at Superlift port, Fig. 4-14 assembling tubing as described in Note 9.
4. Inflate reservoir to 140 psi or maximum pressure available through service valve.

20. Leak Tests

a. Compressor, Reservoir and Regulator

1. Remove assembly, Note 12a.
 2. Connect Test Gage to regulator. Inflate reservoir through service valve to 80-110 psi.
 3. Route an eight inch rubber hose between vacuum and vent ports, Fig. 4-15.
 4. While holding assembly in a vertical position with reservoir end down, immerse in water until the diaphragm is just submerged, Fig. 4-15. Do not submerge completely, as water can enter around the cover gasket. Observe for air leaks at: Reservoir weld seam.
- Reservoir to compressor O-ring. A stream of bubbles may appear in this area and then cease.

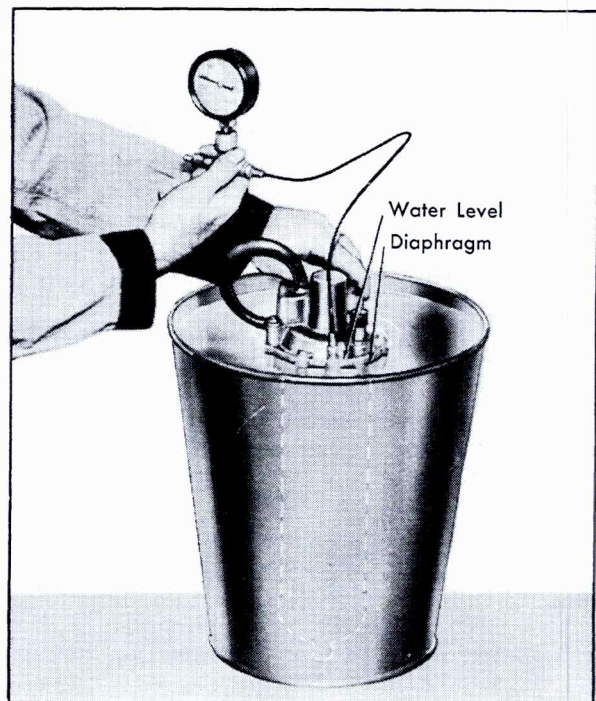


Fig. 4-15 Checking Compressor Assembly for Leaks

The bubbles are caused by atmospheric air being purged from air pockets in the second stage housing. If the bubbles stop in 20 seconds or less there is no leak.

Regulator to compressor O-ring.

Regulator boot - defective internal O-ring.

Diaphragm between first and second stage housings - tightening through-bolts may correct the leak.

Service valve.

Test gage connections.

5. Remove hose from vacuum port and submerge disconnected end in water. Cover vacuum port with finger. Do not permit water to enter through vacuum port. If bubbles are evident, the probable cause is a defective second stage housing check valve.

6. Correct any leaks by either tightening screws or replacing parts.

7. If the cover gasket area is inadvertently submerged, remove cover and tilt unit so that water may drain through openings by distributor valve mechanism. Move distributor valve from side to side until all water is purged. Blow dry with compressed air, both the distributor valve mechanism and the interior of the cover. Replace cover.

If the compressor passes this test, yet fails the output test, the compressor, reservoir and regulator need to be overhauled.

b. Control Valve

1. Remove control valve from car as described in Note 19a.

2. Clean exterior of control valve thoroughly.

3. Connect Test Gage J-22124 and air pressure source to intake adapter and open air pressure (80-110 psi).

4. Submerge unit in water. No air should escape if overtravel lever is in "neutral" position. If bubbles escape from Superlift port, proceed to step 8.

5. Shut off air pressure and detach test gage from air intake port. Plug intake port with Fill Valve, J-21999 (female end).

6. Connect Test Gage to Superlift port and open air pressure.

7. With overtravel lever in "neutral" position

no air should escape. If bubbles escape from exhaust port, proceed to step 8.

8. If the intake valve or exhaust valve is leaking with the lever in the neutral position as evidenced in step 5, Notes 18a and 18b, remove the cover plate and clean out the valve body. Blow air through the intake and exhaust valves while actuating the valves with the lever arm, do not remove the valve cores as they are selected and calibrated in each valve.

9. Install gasket and cover plate and check for leaks. If the valve cores still leak, replace the control valve.

c. Lines and Fittings

1. Disconnect overtravel lever from link.

2. Hold lever up in intake position for maximum Superlift inflation and release.

3. Leak check all connections, with a soap and water solution. Leak test solution may also be used.

d. Superlifts

1. Disconnect lines and remove Superlifts from car as described in Note 2a.

2. Inflate individually to 50-60 psi, utilizing Fill Valves J-21999. Submerge in water and observe for leaks.

3. Install Superlifts as described in Note 2b.

21. Quick Check of Automatic Level Control System

NOTE: If check is performed when car is cold (15°F or less), time delay may be as much as 30 seconds.

1. Record rear trim height of empty car (measure from center of rear bumper to ground).

2. Add weight equivalent to two passenger load to rear of car. Car should begin to level in 4-18 seconds and final position should be approximately $\pm 1/2$ inch of dimension measured above.

NOTE: If gas tank is nearly empty, a 3rd passenger's weight may be needed.

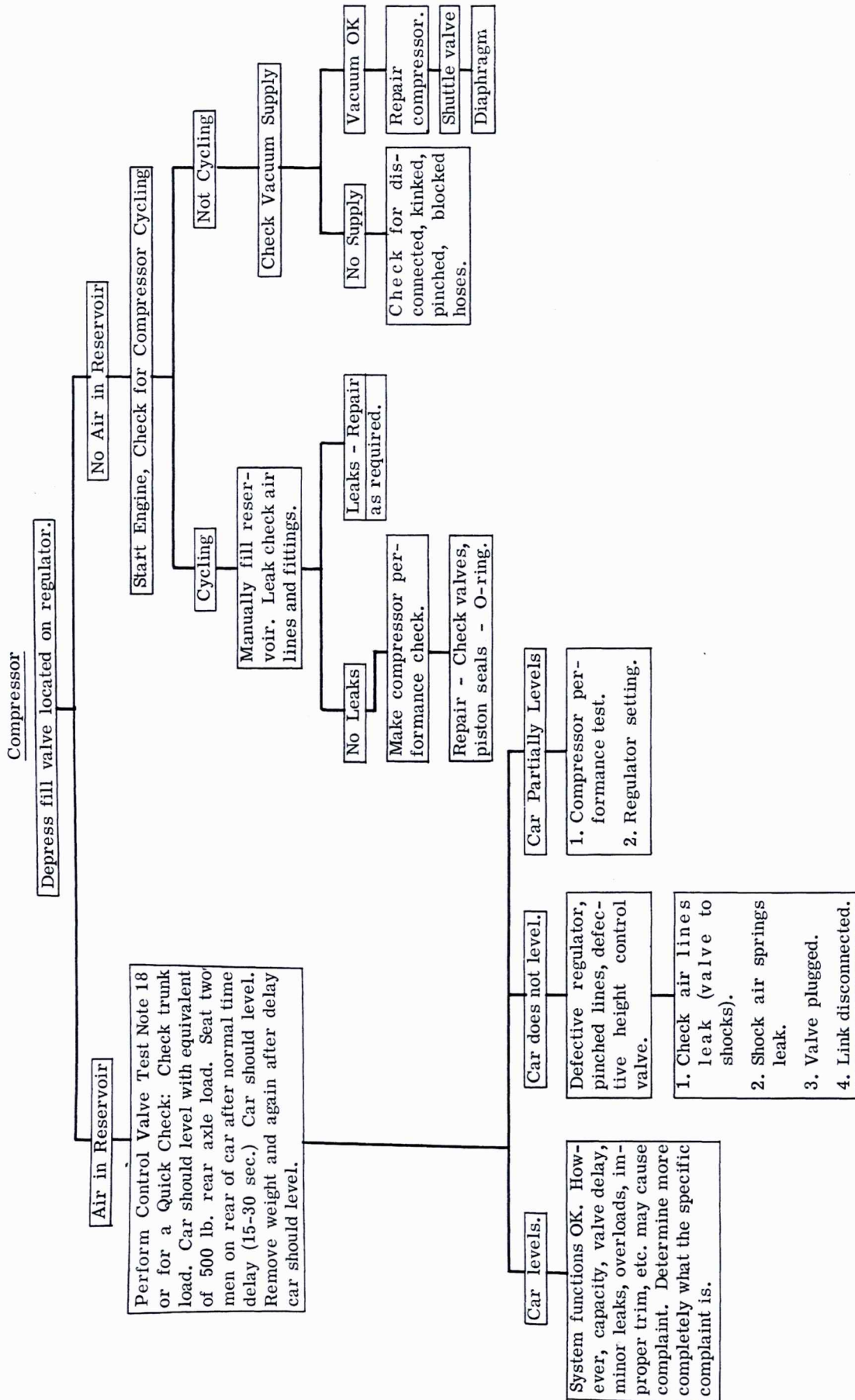
3. Remove weight. After 4-18 seconds car should begin to settle. Final unloaded position should be within approximately $\pm 1/2$ inch of original measurement recorded in step 1.

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot Pounds
300-M	All Upper and Lower Control Link Bolts	1/2-13	90
1335	Rear Leaf Spring U-Bolt Nuts	1/2-20	45
1020	Rear Leaf Spring Front I-Bolt Nut	1/2-20	70
1020	Rear Leaf Spring Shackle Nuts	1/2-20	70
286-M	Self Locking Shock Attaching Nuts		40

NOTE: Refer to Back of manual, Page 16-1 for Bolt and Nut Markings, and Steel Classifications.

DIAGNOSIS CHART (AUTOMATIC LEVEL CONTROL)



After correcting a malfunction, recheck entire system.

REAR SPRING CHART

Style	Color/Code	Normal Load	Rate Per Inch
68069, 68169 (All and 68367 (With Automatic Level Control)	Green BE	1,175	92-98
68247 and 68347 (Without Automatic Level Control)	Gray BC	1,300	111-119
68249, 68349, 68367 and 68369 (Without Automatic Level Control)	*Brown BP	1,350	111-119
68247, 68249, 68347, 68349 and 68369 (With Automatic Level Control)	Orange BJ	1,125	92-98
69723 and 69733	Chartreuse BM	1,500	145-155
69347 (Leaf Spring)	Yellow	905	95
69890 (Leaf Spring)	Green	1,900	230-240
Heavy Duty			
68069, 68169, 68247, 68249, 68347, 68349, 68367, and 68369 .	Chartreuse BM	1,500	145-155
69723 and 69733	Purple BK	1,600	169-181
69890 (Leaf Spring)	Brown	2,120	230-240

*Denotes two color stripes on white background or two color daubs.

CAR WEIGHTS AND STANDING HEIGHTS

Style	Observed Vehicle Weight**		Front Standing Height*	Rear Standing Height*	
	Front	Rear		With Standard Equipment Springs	With Automatic Lever Control Option Springs
68369	2670 to 2770 lbs.	2320 to 2370 lbs.	3-7/8" to 4-5/8"	6" to 6-3/4"	5-1/16" to 5-13/16"
68249, 68347, 49	2650 to 2750 lbs.	2300 to 2350 lbs.	3-7/8" to 4-5/8"	5-15/16" to 6-11/16"	5-1/16" to 5-13/16"
68247	2625 to 2725 lbs.	2275 to 2325 lbs.	3-7/8" to 4-5/8"	5-15/16" to 6-11/16"	5-1/16" to 5-13/16"
68367	2630 to 2730 lbs.	2310 to 2360 lbs.	3-7/8" to 4-5/8"	5-15/16" to 6-11/16"	5-3/4" to 6-1/2"
68069	2730 to 2830 lbs.	2375 to 2425 lbs.	4" to 4-3/4"	5-1/16" to 5-13/16"	
69723	2990 to 3090 lbs.	2650 to 2700 lbs.	4-7/16" to 5-3/16"	6-3/16" to 6-15/16"	
69733	3050 to 3150 lbs.	2730 to 2780 lbs.	4-7/16" to 5-3/16"	6-3/16" to 6-15/16"	
69890 Standard	3000 to 3250 lbs.	3125 to 3575 lbs.	2-3/4" to 3-1/2"	3-7/16" to 4-3/16"	Obtain from Body Builder
69890 High Boy	3000 to 3250 lbs.	3400 to 3850 lbs.	3-3/16" to 3-15/16"	4-1/8" to 4-7/8"	Obtain from Body Builder
69347	2920 to 3070 lbs.	1860 to 1960 lbs.	Note 34, Section 3	Note 34, Section 3	

*Add 3/8" to front and rear standing height for unsettled springs on all styles except 69890. Add 3/8" to front standing height and 3/4" to rear standing height for unsettled springs on 69890. Series 69890 weights do not include extra equipment.

NOTE: On cars equipped with Automatic Level Control, first determine if the unit is working. This can be done by placing the weight of one man on the bumper. Rear of car should first lower and then raise after 4 to 18 seconds.

Do not deflate the Automatic Level Control system when checking the trimmed standing height. The only way to determine if the height is properly trimmed, and if the height control valve is properly adjusted, is to have the Automatic Level Control in operation with air pressure. If system is inoperative, see Note 10, System Test.

**For cars without air conditioning, subtract 122 1/2 lbs. from front end weight. Add 11 1/2 pounds to front end weight on cars equipped with Automatic Level Control.

SERVICE INFORMATION

NOTE: The service information that follows pertains only to the Fleetwood Eldorado. For service procedures not given, refer to the forward portion of the appropriate subsection, as these procedures are the same as for the other 1969 Cadillac models.

22. Rear Vertical Shock Absorber, (Fig. 4-16)

a. Removal

1. Raise rear of car and place jack stands under rear axle.
2. Disconnect Automatic Level Control air line from fitting on shock absorber.
3. Working inside trunk compartment, remove upper retaining nut, retainer and grommet.
4. Remove shock absorber lower mounting nut and bolt.
5. Compress shock absorber, and remove shock absorber from car.

b. Installation

1. Install retainer and grommet on upper stem of shock absorber. Compress shock and insert upper stem through mounting hole in trunk compartment.
2. With a helper working inside of trunk compartment, install second grommet and retainer and retaining nut on upper stem. Tighten retaining nut finger tight.
3. Extend shock and position lower end of shock absorber in mounting bracket so that air fitting points to the front of car and outboard.
4. Install lower mounting bolt and nut. Tighten nut to 40 foot-pounds.
5. Tighten shock absorber upper retaining nut to 8 foot-pounds.
6. Connect Automatic Level Control air line to fitting on shock absorber as described in Note 9.
7. Inflate reservoir to 140 psi or maximum pressure available.
7. Remove jack stands and lower car.

23. Rear Horizontal Shock Absorber, (Fig. 4-16)

a. Removal

1. Raise rear of car and place on jack stands.
2. Remove nut and bolt securing rear of shock absorber to center spring clamp mounting flanges.
3. Remove nut and bolt securing front of shock absorber to frame and remove shock absorber.

b. Installation

1. Position shock absorber to mounts and install bolt and nut securing front of shock absorber to frame, tightening to 40 foot-pounds.
2. Install bolt and nut securing rear of shock

absorber to flanges on center spring clamp, tightening to 40 foot-pounds.

3. Remove jack stands and lower car.

24. Rear Leaf Spring, (Fig. 4-16)

a. Removal

1. Raise rear of car and place on jack stands at frame pads.
2. Support rear axle at center with hydraulic jack.
3. Remove rear wheel from side of car where spring is to be removed.
4. Remove nut securing Automatic Level Control overhead link to axle bracket and remove link from bracket.
5. Remove nut securing front of spring to frame bracket.

NOTE: Do not remove bolt at this time.

6. Remove two nuts retaining rear shackle outer link and remove outer link.
7. Remove four nuts and lockwashers securing center spring clamp to rear axle, and lift up on spring clamp, positioning it out of the way.

NOTE: Remove upper spring insulator from spring, if it did not remain in spring clamp.

8. Lower rear axle on hydraulic jack until axle is free from spring.
9. Remove rear shackle assembly from spring and body.
10. Remove bolt from front of spring and remove spring.

b. Installation

1. Install rear bushings in rear spring eye and in body, after lubricating bushings with tire mounting lubricant, if necessary.
2. Position front of spring to frame bracket and install bolt and nut securing spring to bracket. Do not torque nut at this time.
3. Position rear of spring to body and install rear shackle through spring eye and body hole.
4. Install outer link of shackle and two retaining nuts. Do not torque nuts at this time.
5. Position lower spring insulator on rear axle.
6. Using hydraulic jack, position rear axle to spring, making certain that spring aligning pin locates into axle and that lower spring insulator is properly positioned.
7. Position upper spring insulator and center spring clamp to spring, aligning bolts with rear axle mounting bolts.
8. Install four lockwashers and nuts retaining rear axle to center spring clamp, tightening nuts to 30 foot-pounds.
9. Position Automatic Level Control overtravel lever link to axle mounting bracket and install retaining nut.
10. Install rear wheel previously removed.

11. Remove jack stands and lower car.
12. Torque rear shackle nuts to 40 foot-pounds and front spring attaching bolt to 75 foot-pounds.

25. Height Control Valve—(693)

a. Removal

1. Deflate system, using service valve.
2. Disconnect intake and Superlift air lines from fittings on control valve, Fig. 4-18.
3. Disconnect link from overtravel by removing one nut and lockwasher.
4. Remove two nuts, lockwashers and bolts securing control valve mounting bracket to bracket on wheel well and remove control valve.

b. Installation

1. Position control valve, with time delay mechanism down, mounting bracket to bracket on wheel well, and secure with two bolts, lockwashers and nuts.
2. Secure link to overtravel lever with lockwasher and nut.
3. Connect air lines at control valve intake and Superlift fittings, Fig. 4-18 as described in Note 9.
4. Inflate reservoir, through service valve, to 140 psi or maximum pressure available.

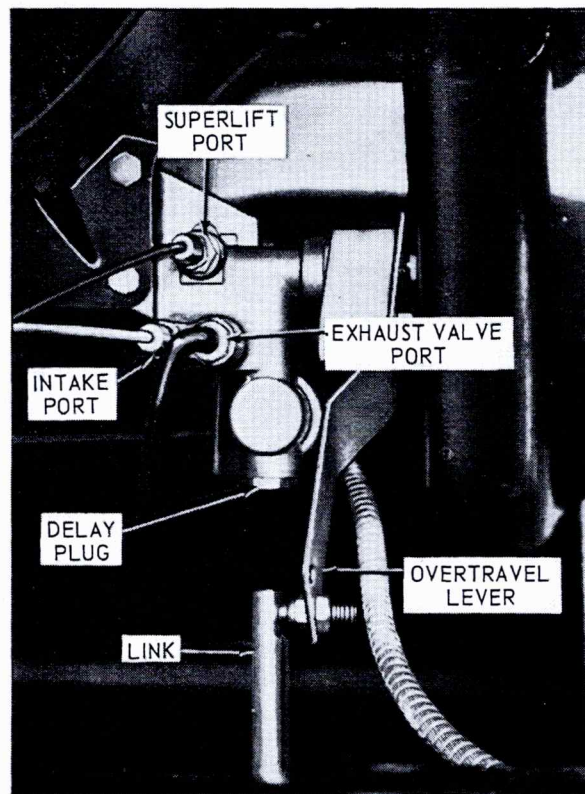


Fig. 4-18 Height Control Valve

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot-Pounds
1111	Vertical Shock Absorber Upper Mount Nut	3/8-24	8
301-M	Vertical Shock Absorber Lower Mount Nut	7/16-14	40
301-M	Horizontal Shock Absorber Nuts	7/16-14	40
286-M	Center Spring Clamp-to-Rear Axle Nuts	3/8-16	30
286-M	Rear Leaf Spring Shackle Nuts	7/16-14	40
301-M	Rear Leaf Spring Front Mounting Nut	1/2-13	75

PROPELLER SHAFT

GENERAL DESCRIPTION

NOTE: The following information is not applicable to the Fleetwood Eldorado.

Propeller Shaft—680,681,682 and 683

A one-piece propeller shaft assembly, Fig. 4-19 is used on all 1969 model Cadillac cars except the Fleetwood Seventy-Five Sedan and Limousine, and the Commercial Chassis. The one-piece propeller shaft used on the Fleetwood Sixty Special Sedan and Broughams, however, is longer and slightly larger in diameter due to the longer wheel base of this body style.

Two constant velocity type universal joint assemblies are used on the one-piece propeller shaft; one in front and one in the rear. A constant velocity universal joint assembly consists of two single joints connected with a special link yoke. A centering ball and socket between the joints maintains the relative position of the two units. This centering device causes each of the two units to operate through one-half of the complete angle between the propeller shaft and transmission and the propeller shaft and differential carrier. The one-piece propeller shaft is serviced as a complete assembly.

This propeller shaft assembly is attached to the differential carrier by means of a double flange connection. A flange on the rear universal joint attached to a flange on the differential carrier pinion by four screws and lockwashers. The assembly is attached to the transmission by means of an internally splined ball stud support slip yoke.

697

A two-piece propeller shaft assembly, Fig. 4-20 that uses three constant velocity type universal joint assemblies, is used on Fleetwood Seventy-Five Sedans and Limousines. Constant velocity universal joint assemblies are located

at each end and in the center of the propeller shaft assembly.

On the front end of the rear section of the propeller shaft assembly is a splined slip yoke that fits into a splined coupling in the rear end of the front section of the propeller shaft assembly. This slip spline permits the slight lengthening and shortening of the propeller shaft assembly required by the movement of the rear axle.

The propeller shaft assembly is attached to the transmission by means of a splined ball stud support slip yoke, and attached to the differential carrier pinion by means of the double flange connection previously described. In addition, this propeller shaft assembly is supported in the center by a center bearing support and bracket assembly located on a frame cross member.

With the exception of the center bearing and support, this propeller shaft is serviced as a complete assembly.

698

A two-piece propeller shaft assembly, Fig. 4-25 that uses three standard universal joints, is used on the Commercial Chassis. Standard universal joints are located at each end and in the center of the propeller shaft assembly.

The standard universal joints used on the Commercial Chassis are replaceable, but cannot be repacked. On original universal joints, the injected nylon ring that retains the bearing cup in the yoke will shear off when the bearing is removed. There are no provisions for replacing the nylon ring other than installing a new universal joint with the conventional snap ring retainers. The only time disassembly is recommended is when the universal joint should be replaced, because it has become loose, worn or noisy.

The front and rear halves of this propeller shaft assembly are splined together in the same manner as the propeller shaft assembly used on Fleetwood Seventy-Five Sedans and Limousines.

The propeller shaft assembly on the Commercial Chassis is attached in the same manner as

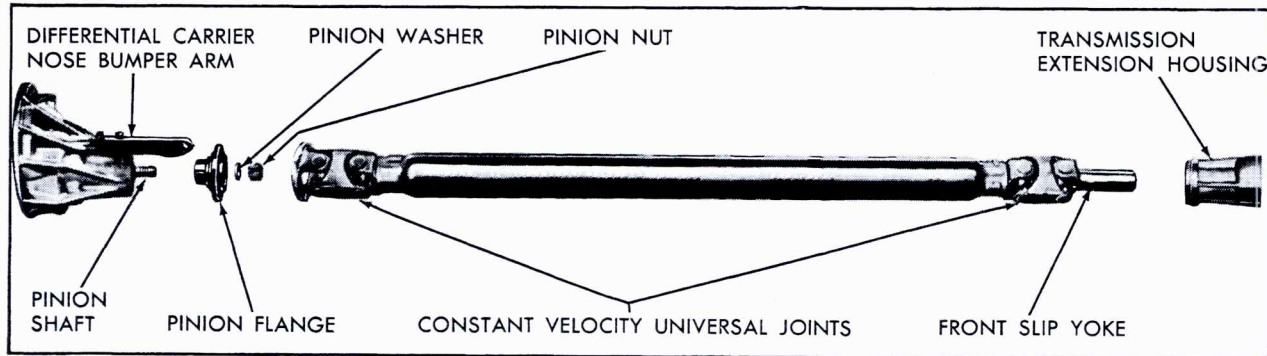


Fig. 4-19 Propeller Shaft (680-1-2-3)

described for 697 series cars. However, on 698 series cars, the propeller shaft assembly is supported in the center by an adjustable center bearing support and bracket assembly located on a

frame cross member. The center bearing support is adjustable to compensate for various load conditions.

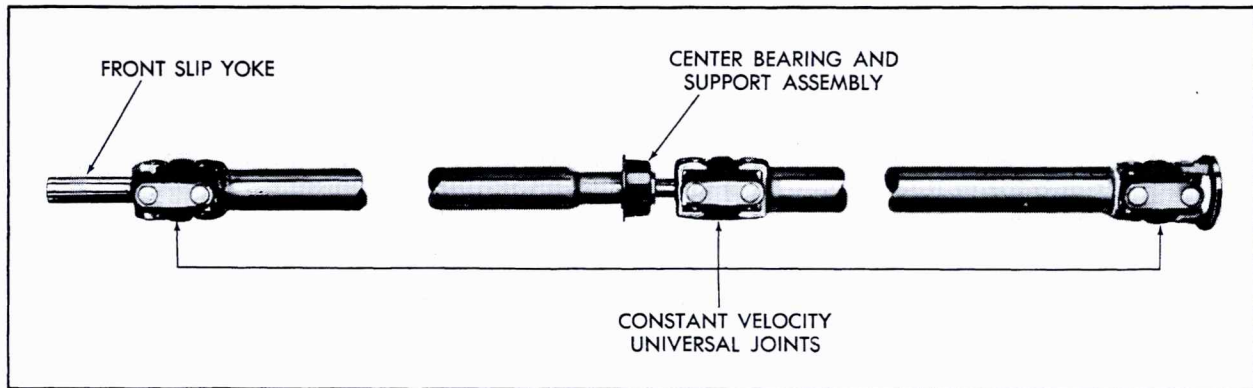


Fig. 4-20 Propeller Shaft (697)

SERVICE INFORMATION

NOTE: The following information is not applicable to the Fleetwood Eldorado.

CAUTION: If any mispositioning, incorrect assembly, or failure of components in the area of the brake system pipes, hoses, or cylinders is observed, be sure to check for any brake damage that may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly or failure include the exhaust system, shock absorber, springs, suspension control arms, stabilizer bar, power steering pump hoses and transmission cooler pipes.

26. Slip Yoke Maintenance— One Piece Propeller Shaft

The propeller shaft slip yoke does not require a periodic maintenance interval. However, if stickiness should develop at the slip yoke on one-piece propeller shaft cars at high mileage, the slip yoke should be serviced.

To service slip yoke, remove propeller shaft from car. Thoroughly clean slip yoke with washing gas or kerosene. Lubricate inside diameter of slip yoke with approximately two tablespoons of synthetic oil seal lubricant, and outside diameter with type "A" transmission oil. This service procedure should also be followed whenever propeller shaft is removed from car.

27. Propeller Shaft Assembly— All Except 697 and 698

a. Removal

1. Position car on hoist. Place transmission selector lever in Park to keep propeller shaft from turning, and raise car on hoist.

2. Remove from rear universal joint flange two of the four attaching screws and lockwashers that are accessible.

3. Disconnect linkage at transmission, and shift transmission into Neutral position.

4. Rotate propeller shaft to gain access to remaining two flange attaching screws. Shift transmission back to Park position.

5. Remove remaining two flange attaching screws and lockwashers from rear universal joint flange.

CAUTION: Before removing the two remaining flange screws, install support chain as shown in Fig. 4-39. Do not permit propeller shaft to be supported by the front constant velocity universal joint only.

6. Remove propeller shaft by pushing shaft forward so that rear universal joint flange clears pinion shaft, then remove shaft by pulling rearward to disengage slip yoke.

7. Install cardboard shipping cover, or similar protective device, on front slip yoke to keep slip yoke as clean as possible.

8. Install spare yoke into transmission extension housing to prevent loss of oil.

b. Installation

1. Remove any nicks, burrs or dirt from differential carrier pinion flange and from mating flange on rear constant velocity joint.

2. Remove cardboard cover and clean slip yoke, if necessary, avoiding the use of anything that may scratch or damage yoke. Lubricate I.D. of slip yoke with approximately two tablespoons of synthetic oil seal lubricant, and O.D. with type "A" transmission fluid.

3. Remove spare yoke previously installed in

transmission extension housing, and install slip yoke on transmission output shaft.

4. Position propeller shaft to differential carrier, and connect rear universal flange to pinion flange with two attaching screws and lockwashers. Torque screws to 65 foot-pounds.

CAUTION: Do not use a pry bar or heavy tool to hold propeller shaft when tightening flange attaching screws, as universal joint bearing seals would be damaged.

5. Shift transmission into Neutral position and rotate propeller shaft to gain access to two remaining screw holes.

6. Shift transmission back into Park position.

7. Install remaining two attaching screws and lockwashers at rear universal joint flange. Torque screws to 65 foot-pounds and remove support chain.

8. Connect linkage at transmission.

9. Lower car on hoist.

10. Check transmission oil level as described in Section 7, Note 7.

28. Propeller Shaft Assembly— 697 and 698

a. Removal

1. Position car on hoist. Place transmission selector lever in Park to keep propeller shaft from turning, and raise car on hoist.

2. On 698 series cars, mark position of the center support with respect to the frame cross member.

3. Remove the two center bearing support to frame bolts, nuts, and lockwashers.

4. Remove from rear universal joint flange two of the four attaching screws and lockwashers that are accessible and install support chain, Fig. 4-39.

5. Disconnect linkage at transmission, and shift transmission into Neutral position.

6. Rotate propeller shaft to gain access to remaining two flange attaching screws. Shift transmission back to Park position.

7. Remove remaining two flange attaching screws and lockwashers from rear universal joint flange.

CAUTION: Do not permit the rear section of propeller shaft to be supported by the center universal joint as internal damage may result.

8. Push rear section of propeller shaft forward so that rear universal joint flange clears pinion shaft.

9. Slide propeller shaft rearward until front slip yoke comes off of transmission output shaft and install cardboard shipping cover, or similar protective device, on front yoke.

NOTE: The cardboard cover will prevent nicking of the yoke during removal as well as keeping the yoke as clean as possible.

10. Withdraw propeller shaft through frame cross member, removing it from the rear.

11. Install a spare yoke into transmission extension housing to prevent oil loss.

b. Installation

1. Remove cardboard cover and clean slip yoke, as necessary. Avoid using anything that may scratch or damage yoke.

2. Replace cardboard cover on yoke.

3. Remove any nicks, burrs or dirt from differential carrier pinion flange and from mating flange on rear universal joint.

4. Slide propeller shaft assembly through frame cross member from rear of car.

5. Remove cardboard cover from front yoke and lubricate yoke with type "A" transmission fluid.

6. Remove spare yoke previously installed in transmission extension housing and install front yoke on transmission output shaft.

7. Position propeller shaft to differential carrier, and connect rear universal flange to pinion flange with two attaching screws and lockwashers. Torque screws to 65 foot-pounds.

CAUTION: Do not use a pry bar or heavy tool to hold propeller shaft when tightening flange attaching screws, as universal joint bearing seals would be damaged.

8. Shift transmission into Neutral position and rotate propeller shaft to gain access to two remaining screw holes.

9. Shift transmission back into Park position.

10. Install remaining two attaching screws and lockwashers at rear universal joint flange. Torque screws to 65 foot-pounds and remove support chain.

11. On 698 series cars, relocate center support to its original position to the frame cross member as marked before removal.

12. Install two center bearing support-to-frame bolts, nuts and lockwashers. Torque nuts to 16 foot-pounds.

13. Connect linkage at transmission.

14. Lower car on hoist.

15. Check transmission oil level as described in Section 7 Note 7.

29. Propeller Shaft Front Slip Yoke Leak Test—697 and 698

1. Remove propeller shaft as described in Note 28a.

2. Hold open end of yoke up and fill with washing gas or kerosene.

CAUTION: Use of cleaning solvents, other than those recommended, may cause damage to the seal.

3. Check area around yoke plug for signs of leaking.

4. If plug is loose or leaks, install new propeller shaft assembly on 697 series cars. On

698 series cars, install new slip yoke and front universal joint assembly.

5. After leak test, remove all traces of washing gas or kerosene with compressed air.

6. Install propeller shaft as described in Note 28b.

30. Propeller Shaft Center Bearing Support Adjustment—698

On cars equipped with standard universal joints, propeller shaft vibrations may occur as the car is driven under differing loading conditions. These vibrations are more noticeable at low speed acceleration (10 to 40 MPH). Because the weight of the commercial chassis series varies considerably, according to its application, the center bearing support is adjustable to compensate for various loads. The support is positioned in the lowest adjusting hole for light loads at the factory. To correct propeller shaft vibration on commercial chassis cars, proceed as follows:

1. Measure rear standing height as described in Note 1, except measure the height under operating conditions with driver and operating equipment loaded in car.

2. Remove adjusting bolt and lockwasher from frame center cross member, Fig. 4-21, and loosen pivot bolt. Align center bearing support with center frame cross member as determined from the following table and install bolt and lockwasher. Torque bolts evenly to 16 foot-pounds.

*Rear Standing Height	Support Alignment Position
Below 1-3/4 inch	Top
1-3/4 inch to 3-1/2 inch	Center
3-1/2 inch to 5-1/4 inch	Lowest
Above 5-1/4 inch	Lowest, and shim as described in step 3.
*With driver and operating equipment loaded in car.	

3. If rear standing height (as determined under conditions outlined in step 1), is above 5-1/4 inches, the rear of engine may be raised by adding shims of equal thickness on both sides of rear engine support cross member between frame extension and support cross member. Rear of engine may be shimmed equally any distance up to 1/4 inch. Do not shim between support and transmission as this point is already shimmed at the factory. (Longer cross member bolts may be required.)

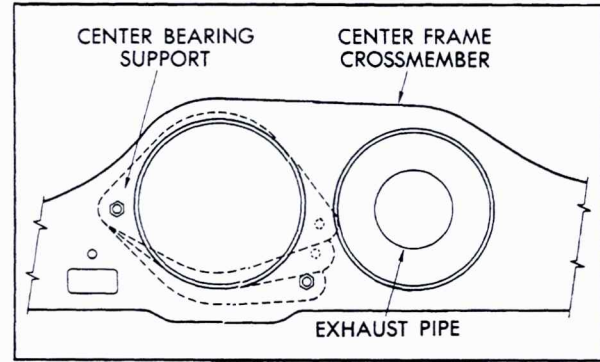


Fig. 4-21 Adjusting Center Bearing Support (698)

4. After raising engine by shimming, check the drive line to make sure there is sufficient operating clearance.

5. Check transmission and throttle linkage and adjust if required.

31. Standard Universal Joints—698

Disassembly and repacking of the universal joints should not be attempted. Disassembly is recommended only when joint is loose, worn or noisy, and then universal joint should be replaced. When an original universal joint has been disassembled, it cannot be reassembled because there are no provisions for replacing the injected nylon ring between the bearing cup and yoke. Disassembly and repacking of replacement joints is not recommended because changes in the normal wear pattern on the needles will result in premature wear and eventual failure.

NOTE: Constant velocity type universal joints are not serviced separately from propeller shaft assembly. The following procedure pertains to standard universal joints used on Commercial Chassis.

a. Removal

1. Remove propeller shaft assembly as described in Note 28a.

2. If universal joint being removed is a replacement joint, remove lock rings from bearings. On original universal joints, the injected nylon ring will shear off when bearing is removed.

3. Scribe alignment marks on yoke and shaft so that shaft parts can be reassembled with original indexing.

4. Support yoke or bearing trunnion on vise jaws, position Bearing Remover, J-4174, over end of bearing cup, and pound on remover tool with a hammer until bearing is driven out of yoke and into remover tool about 1/2 inch, Fig. 4-22.

NOTE: Only one size universal joint bearing is used. Use Bearing Remover, J-4174, for removing bearings.

5. Place Bearing Remover with bearing in vise.

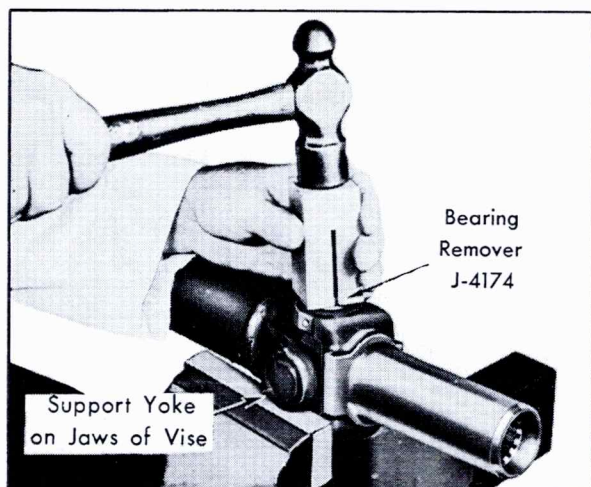


Fig. 4-22 Installing Bearing Remover Tool

Tighten vise until bearing is held securely by tool, then drive yoke away from tool until bearing is removed, Fig. 4-23.

6. Repeat steps 3 to 5 on other bearings. Remove and discard universal joint cross.

b. Installation

1. Start one bearing and seal assembly into propeller shaft yoke by tapping lightly with a hammer, being careful not to dislocate needles in bearing.

2. Check holes in ends of cross arms, making certain they are filled with universal joint grease.

3. Install universal joint cross in position and guide into bearing already started.

4. Start opposite bearing into propeller shaft yoke and place in vise with jaws against bearings, Fig. 4-24.

5. Tighten vise until cross is just ready to enter opposite bearing and adjust position of cross until it enters both bearings.

6. Tighten vise until both bearings are in far enough to allow lock rings to be installed.

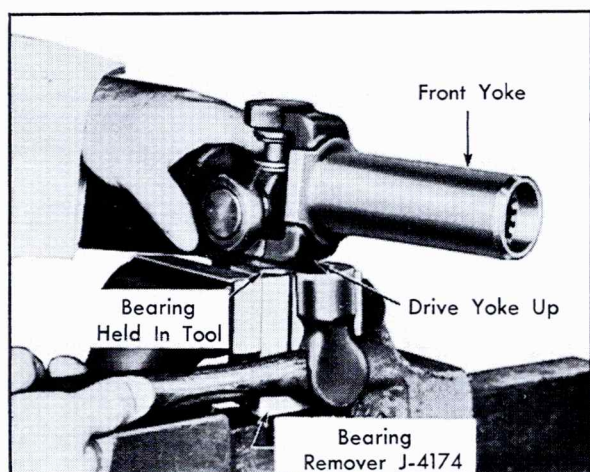


Fig. 4-23 Removing Universal Joint Bearing

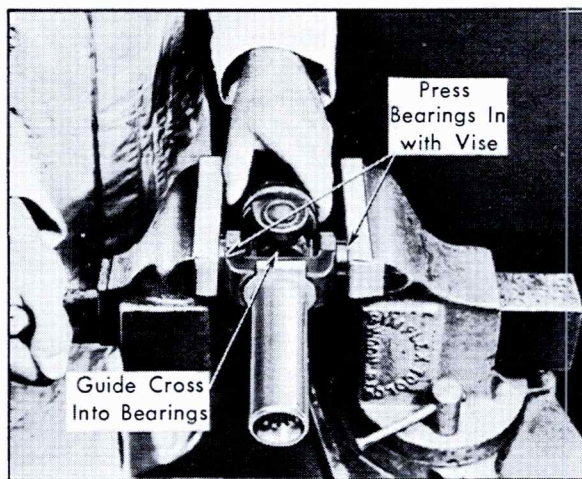


Fig. 4-24 Installing Universal Joint Bearing

NOTE: If bearings do not go into position with normal pressure on the vise, a needle bearing may have fallen out of place. Remove bearing and reposition needle.

CAUTION: Whenever all needles are removed from bearing assembly, make certain that the thicker plastic ring is installed in bottom of bearing cup before installing needles, and that the thin plastic ring is installed between the needle ends and rubber seal.

7. Install lock rings, making certain that they are properly seated in groove.

8. Repeat above procedure on remaining bearings.

NOTE: Make certain that scribe mark on yoke aligns with scribe mark on shaft.

9. Install propeller shaft assembly as described in Note 28b.

32. Front and Rear Propeller Shaft Sections—697 and 698

a. Disassembly

1. Remove propeller shaft assembly as described in Note 28a.

2. Pry up center bearing lock retainer, Fig. 4-25.

3. Back off center bearing retainer nut, using Center Bearing Retaining Nut Remover and Installer, J-21009, and separate front and rear propeller shafts by sliding front shaft off center slip yoke.

4. Remove and discard center bearing lock retainer.

5. Remove center slip yoke seal, split washer, and center bearing retaining nut from slip yoke. Discard seal and split washer.

b. Assembly

1. Clean inner spline of front propeller shaft and spline of center slip yoke.

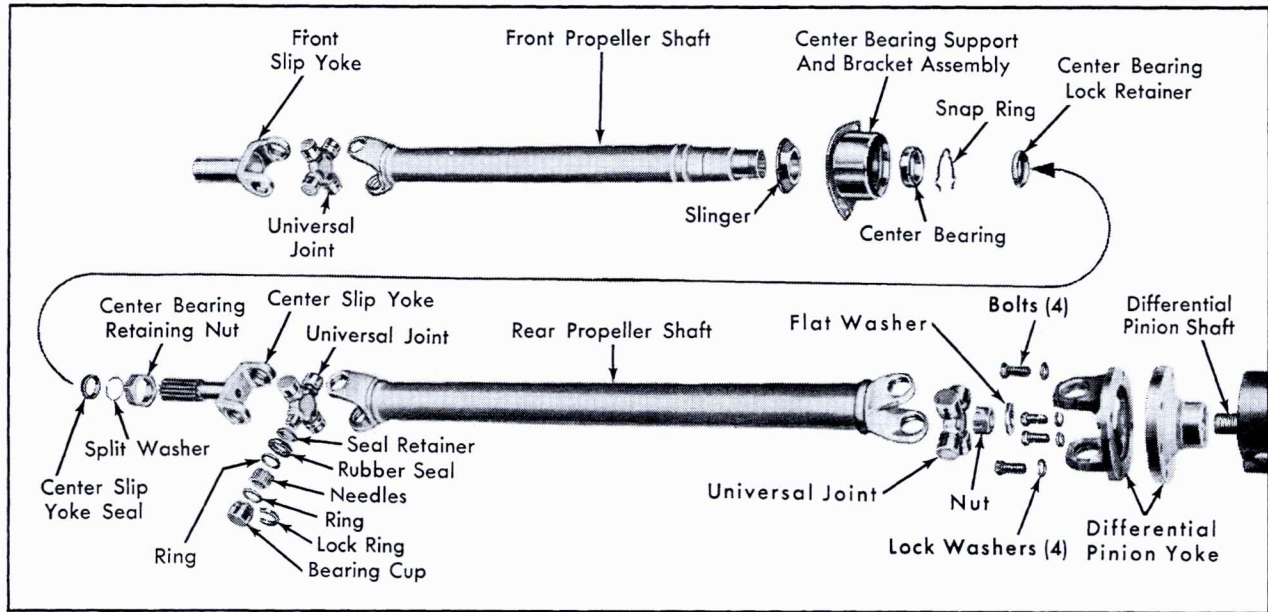


Fig. 4-25 Propeller Shaft Disassembled (698)

2. Install center bearing retaining nut on slip yoke with threaded end toward front propeller shaft.

3. Install new split washer, being sure to slide washer securely against inner shoulder of retaining nut.

4. Slide new slip yoke seal over center slip yoke and into retaining nut.

5. Install new center bearing lock retainer on center slip yoke.

6. Coat inner spline of front propeller shaft and spline of center slip yoke with center bearing slip yoke lubricant available from servicing Parts Warehouses.

7. Align wire clip on end of center slip yoke

with missing land on inner spline of front shaft and slide center slip yoke into front propeller shaft spline.

8. Tighten center bearing retaining nut to 55 foot-pounds using Center Bearing Retaining Nut Remover and Installer J-21009, and a torque wrench, Fig. 4-26.

CAUTION: Particular care should be taken in application of torque wrench and installer tool, to prevent over-torquing the nut. Hold torque wrench perpendicular to installer tool to cancel off-set error on torque reading.

9. Bend edge of center bearing lock retainer in two places to lock center bearing retaining nut.

10. Install propeller shaft assembly as described in Note 28b.

33. Propeller Shaft Center Bearing—697 and 698

a. Removal

1. Remove propeller shaft assembly as described in Note 28a.

2. Disassemble front and rear propeller shafts as described in Note 32a.

3. Remove center bearing support and bracket assembly from front propeller shaft by tapping on front side of assembly with a soft head hammer.

4. Remove slinger from end of propeller shaft.

5. Pry out snap ring from open side of bearing retainer and remove bearing from support bracket by tapping lightly from rear with a soft head hammer.

b. Installation

1. Install bearing into bearing retainer, pressing on outer race of bearing only. Use care not

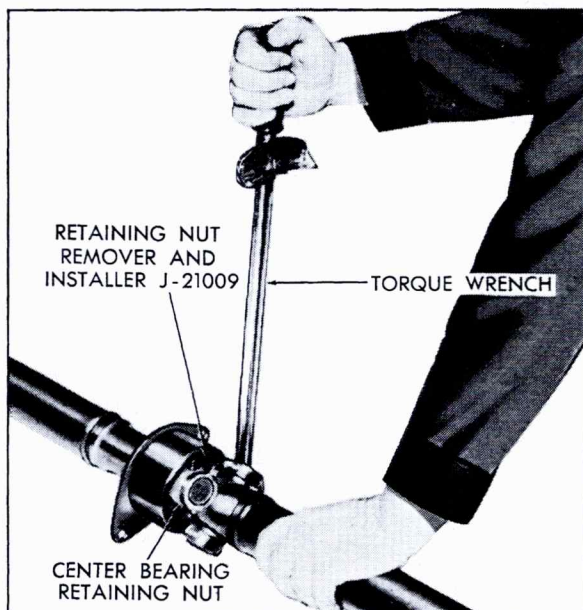


Fig. 4-26 Tightening Center Bearing Retainer Nut

to damage bearing or support, and secure bearing in retainer with snap ring.

2. Pack front and rear face of center bearing with heavy duty water pump grease.

3. Install slinger on front propeller shaft.

4. Position center bearing support assembly on rear of front propeller shaft with snap ring facing rear end of shaft.

NOTE: It may be necessary to tap alternately on inner race of bearing with a brass drift to permit clearance for installing retaining nut.

5. Assemble front and rear propeller shafts as described in Note 32b.

6. Install propeller shaft assembly as described in Note 28b.

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot-Pounds
300-M	Pinion Flange to Universal Joint Flange Attaching Screws.	7/16-20	65
Special	Prop Shaft Center Bearing Retaining Nut (697 and 698).	1-9/16-18	55
300-M	Center Bearing Support Bolts (697 and 698).	5/16-24	16

NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings and steel classifications.

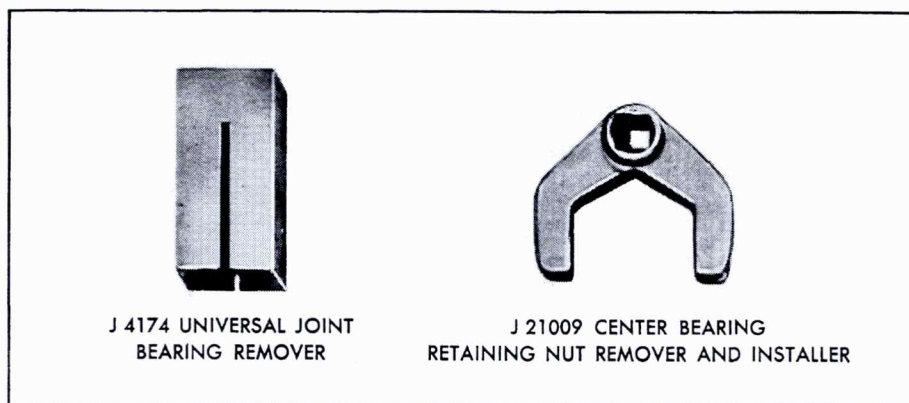


Fig. 4-27 Special Tools

GENERAL DESCRIPTION

NOTE: For information pertaining to the Fleetwood Eldorado refer to the latter portion of the appropriate subsection.

The rear axle housing used on 1969 model Cadillac cars is of a five piece design that minimizes the weight while providing an optimum amount of surface area for cooling efficiency.

The housing has six attaching brackets; two for the rear lower control links, two for the rear upper control links and two for the rear springs. The 698 series cars, however, have spring pads in place of the two spring attaching brackets.

The axle housing has a vent fitting located on

the left hand side to prevent internal pressure from building up.

Greased and sealed rear wheel bearings are used on 1969 model Cadillac cars. The bearings are sealed on the outer side by a rubber grease seal that is an integral part of the bearing. The inner oil seal, however, can be serviced separately from the bearing. The rear wheel bearings require no periodic lubrication or adjustment. Sealing between the outer diameter of the bearing and inner diameter of the axle housing is accomplished by an O-ring seal that should be replaced whenever the axle shaft and bearing assembly is removed.

SERVICE INFORMATION

CAUTION: If any mispositioning, incorrect assembly, or failure of components in the area of the brake system pipes, hoses, or cylinders is observed, be sure to check for any brake damage that may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly or failure include the exhaust system, shock absorber, springs, suspension control arms, stabilizer bar, power steering pump hoses and transmission cooler pipes.

34. Rear Axle Backlash Measurement

1. Place car on hoist.
2. To prevent rotation of pinion flange or yoke, use corresponding holding tool, and clamp tool handle to lower control link.
3. Pull parking brake cable on one wheel to prevent wheel from turning. (This is not necessary on cars equipped with a Controlled Differential).
4. Measure rotation (backlash) of opposite wheel in inches at outer circumference of tire tread. A stiff wire pointer fastened to the fender or car frame will aid in this measurement. Maximum backlash under this condition should not exceed 1/2 inch on standard differentials and 1/8 inch on Controlled Differentials.

35. Rear Wheel and Brake Drum

a. Removal

1. Raise rear end of car, place jack stands under rear frame rails, and remove wheel.

NOTE: Remove wheel spacer on 698 Series vehicles.

2. Remove one screw holding brake drum to axle shaft flange.
3. Remove brake drum.

b. Installation

1. Install brake drum on rear axle shaft flange and secure with one screw.

NOTE: Install wheel spacer on 698 Series vehicles.

2. Install wheel and replace wheel mounting nuts.
3. Remove jack stands, lower car and tighten wheel nuts to 105 foot-pounds.

36. Axle Shaft, Bearing Oil Seal, and Wheel Bearing

a. Removal of Axle Shaft and Bearing Assembly

1. Raise rear end of car and remove wheel and brake drum as described in Note 35a.
2. Remove four nuts and lockwashers that hold cover, gasket, and backing plate to rear axle housing, Fig. 4-28.
3. Install Axle Shaft Puller, J-21579, on studs of rear axle shaft flange. Install Adapter, J-6219-4, on Slide Hammer Assembly, J-2619, and install assembly in puller, Fig. 4-29.
4. Drive outward with slide hammer to remove axle shaft assembly. Remove and discard cover gasket.

b. Replacing Rear Wheel Bearing Oil Seal

NOTE: Step 1 pertains to 698 style vehicles only, for all other styles proceed to step 2.

1. If procedure is being performed on 698 style vehicle, proceed as follows:
 - a. Center punch location of drill holes on bearing retainer, following layout illustrated in Fig. 4-30.
 - b. Drill two 1/4 inch holes, 1/2 inch deep, into side of bearing retainer, Fig. 4-30.

CAUTION: Use extreme care to avoid drilling holes more than 1/2 inch deep, as axle shaft would be damaged.

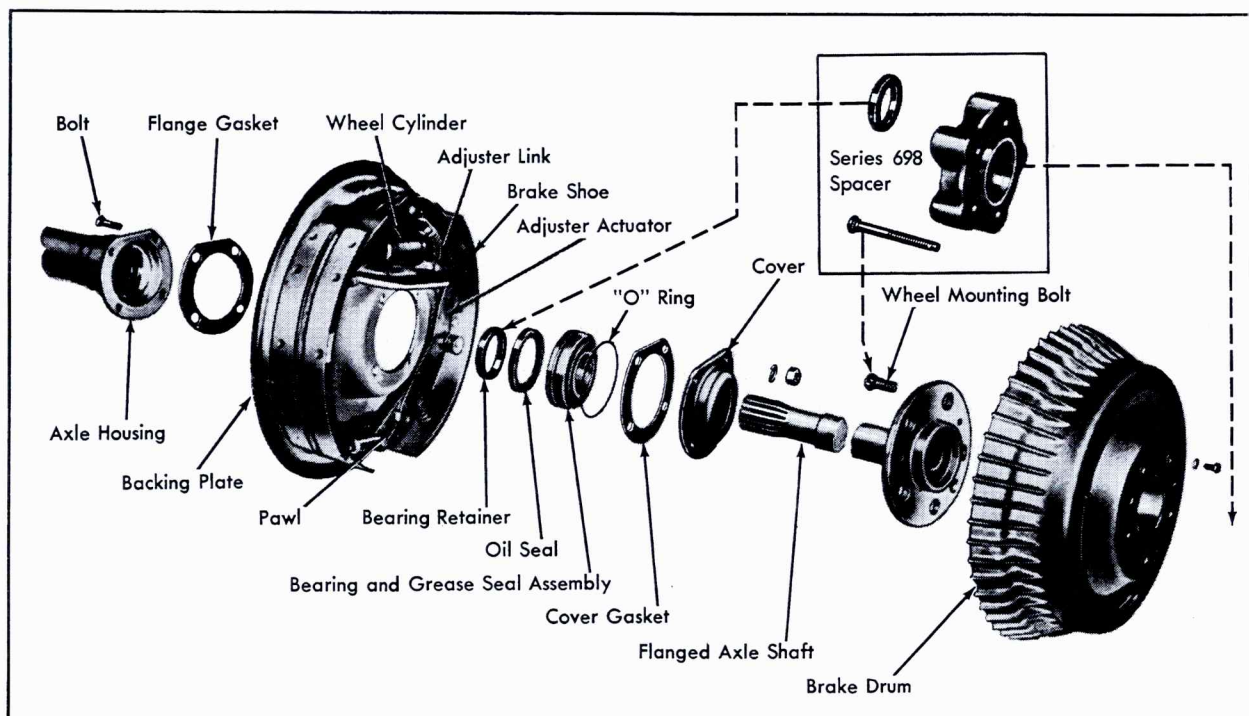


Fig. 4-28 Rear Wheel Disassembled

2. Using a cold chisel and hammer, notch bearing retainer next to bearing, being careful not to damage bearing.

NOTE: Bearing retainer need not be completely split. Drive chisel into retainer only until retainer can be slipped off shaft, then remove retainer.

3. Wipe shaft and bearing clean.

4. Remove oil seal from bearing using Oil Seal Remover, J-21010, Fig. 4-31. Hook slotted flange of remover tool under rolled edge of seal case and pry up on tool handle. Then slide seal off axle shaft.

NOTE: If bearing grease has been diluted by axle oil, drain and wipe out oil.

5. Squeeze contents of tube of wheel bearing grease included in seal replacement kit inside

the bearing. Also apply a thin film of grease around lip of seal.

6. Install new oil seal on axle shaft with spring side of seal toward splined end of shaft. Position seal in bearing and press seal into bearing using Oil Seal Installer, J-21011, as a slide hammer, Fig. 4-32, until metal case of seal is flush with top of bearing.

NOTE: Seal may also be installed by letting installer tool slide down axle shaft under its own weight.

7. Install new bearing retainer on axle shaft. Insert axle shaft through ring of Bearing Installer, J-6257, and U-shaped piece of Bearing

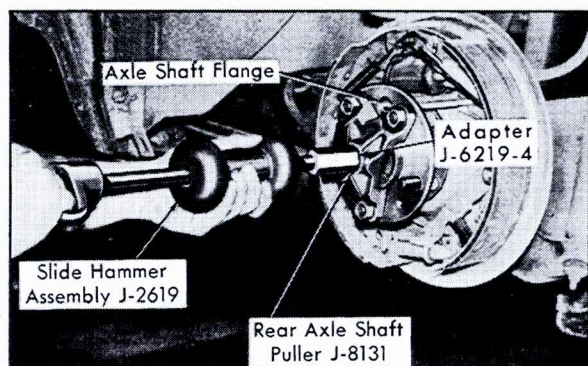


Fig. 4-29 Removing Rear Axle Shaft

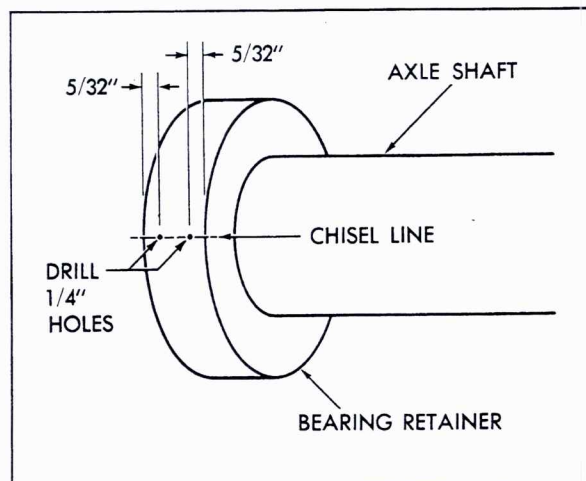


Fig. 4-30 Removing Bearing Retainer (698)

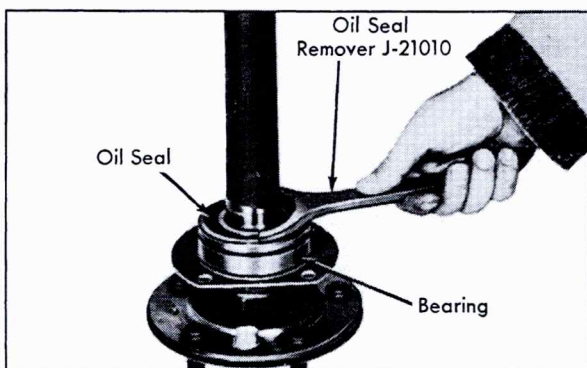


Fig. 4-31 Removing Oil Seal From Bearing

Plate and Pin Assembly, J-2986-1, and place on arbor press.

8. Press shaft through retainer until retainer just contacts bearing. Remove shaft assembly from installer tools.

c. Replacing Rear Wheel Bearing and Seal Assembly

NOTE: Step 1 pertains to 698 style vehicles only, for all other styles proceed to step 2.

1. If procedure is being performed on 698 style vehicle, proceed as follows:

a. Center punch location of drill holes on bearing retainer, following layout illustrated in Fig. 4-30.

b. Drill two 1/4 inch holes, 1/2 inch deep, into side of bearing retainer, Fig. 4-30.

CAUTION: Use extreme care to avoid drilling holes more than 1/2 inch deep, as axle shaft would be damaged.

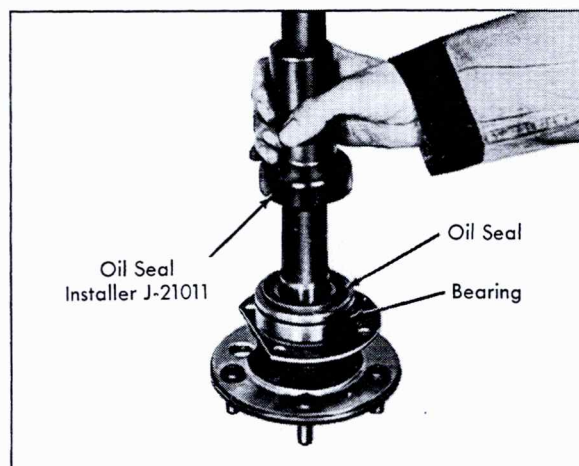


Fig. 4-32 Installing Oil Seal in Bearing

2. Using a cold chisel and hammer, notch bearing retainer next to bearing.

NOTE: Bearing retainer need not be split. Drive chisel into retainer only until retainer can be slipped off shaft, then remove retainer.

3. Place rear axle shaft and bearing assembly in U-shaped piece of Rear Wheel Bearing Plate and Pin Assembly, J-2986-1, and position on arbor press.

CAUTION: Make certain that axle shaft flange is properly centered in arbor press and free from any obstructions.

4. Install Rear Wheel Bearing Holding Tool, J-2986-3, around bearing and over dowels, Fig. 4-33.

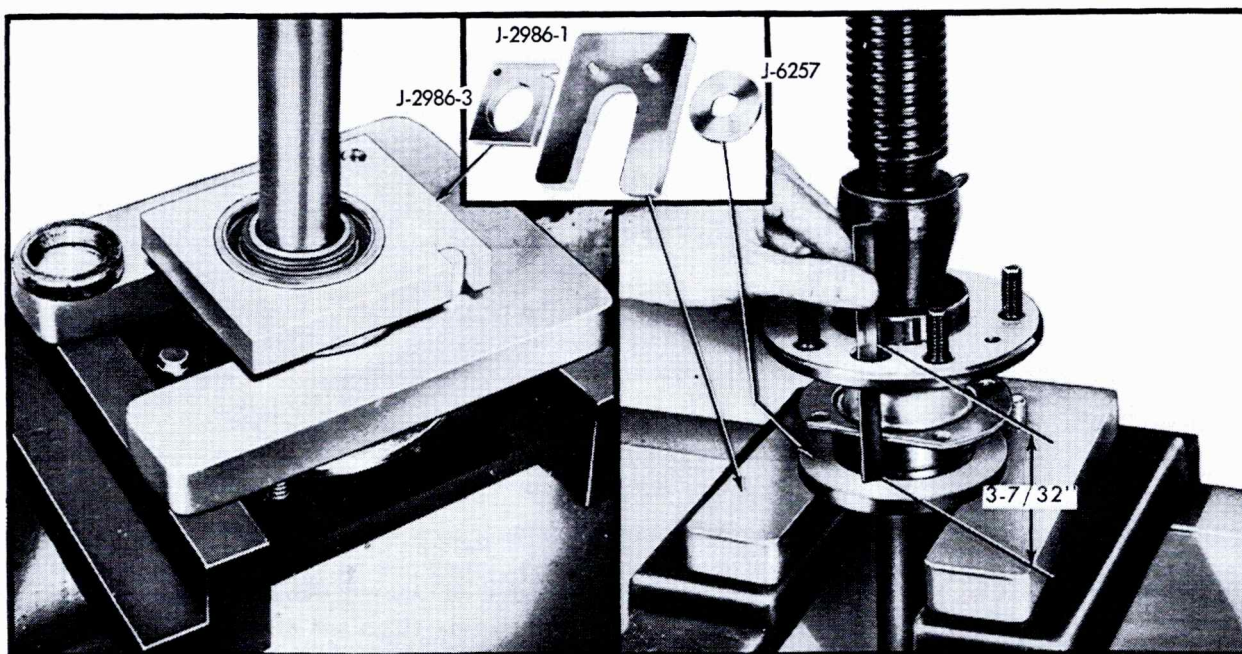


Fig. 4-33 Removing and Installing Rear Wheel Bearing

CAUTION: Step 3 must be performed to decrease danger of bearing exploding while under arbor press load.

5. Press axle shaft through bearing and remove bearing.

NOTE: If rear wheel bearing has been removed because of failure, inspect axle housing and differential carrier for metal chips, and clean thoroughly if necessary.

6. Inspect cover for damage. Replace if necessary.

7. Install new wheel bearing and seal assembly on shaft so that O-ring groove is toward splined end of axle shaft.

8. Insert axle shaft through ring of Bearing Installer, J-6257, and U-shaped piece of Bearing Plate and Pin Assembly, J-2986-1, and place on arbor press, Fig. 4-33.

9. Press bearing on shaft so that there is 3-7/32 inch clearance between outer surface of axle shaft flange and inner end of wheel bearing inner race, Fig. 4-33.

10. Release arbor press and remove axle shaft from installer tools.

11. Install new bearing retainer on axle shaft and reinstall shaft on installer tools.

NOTE: Install ring with chamfer toward bearing.

12. Press shaft through retainer until retainer just contacts bearing. Remove shaft from installer tools.

d. Installation of Axle Shaft and Bearing Assembly

1. Apply film of differential lubricant to wheel bearing bore in axle housing after checking for burrs and nicks.

2. Lubricate O-ring seal. Use a new gasket on cover and a new O-ring seal on wheel bearing and install axle shaft, being careful not to damage O-ring seal.

NOTE: Whenever axle shaft is removed, always install a new O-ring seal on wheel bearing.

3. Install four nuts and lockwashers on rear axle housing bolts, to hold cover, gasket, and brake backing plate in place, and tighten by inserting a socket wrench through large hole in rear axle flange. Torque nuts to 40 foot-pounds.

4. Install brake drum and one retaining screw.

5. Install wheel and lower car. Torque wheel mounting nuts to 105 foot-pounds.

SPECIFICATIONS

Item	All Styles Unless Otherwise Noted
Axle Shaft Length	
Left Side	29-23/32"
Right Side	32-21/64"
Axle Shaft Run-Out (at ground surface near splines) . . . . .	.006" Maximum
Outer Surface of Axle Shaft Flange to Inner End of Wheel Bearing Inner Race	3-7/32"

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot-Pounds
286-M	Brake Backing Plate to Axle Housing Nuts	3/8-24	40
286-M	Differential Carrier to Axle Housing Nuts	3/8-24	37
1111	Wheel Mounting Nuts	1/2-20	105

NOTE: Refer to back of manual, Page 16-1, for bolt and nut markings and steel classifications.

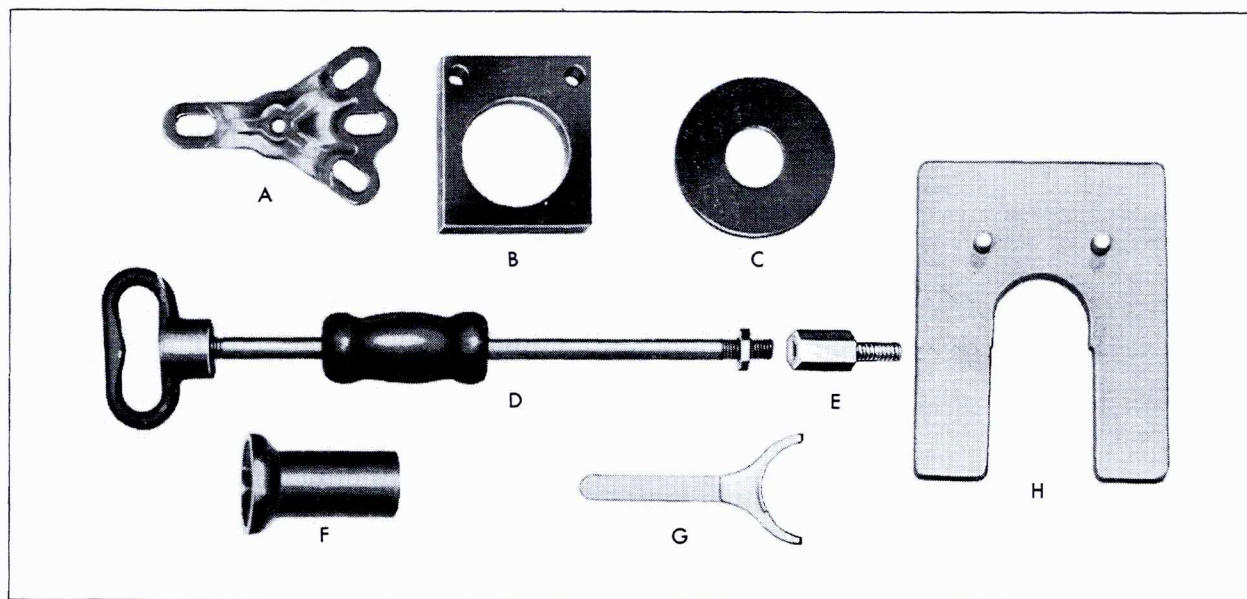


Fig. 4-34 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-21579	Rear Axle Shaft Puller	F	J-21011	Rear Wheel Bearing Oil Seal Installer
B	J-2986-3	Rear Wheel Bearing Holding Tool	G	J-21010	Rear Wheel Bearing Oil Seal Remover
C	J-6257	Rear Wheel Bearing Installer	H	J-2986-1	Rear Wheel Bearing Plate and Pin Assembly
D	J-2619	Slide Hammer			
E	J-6219-4	Adapter			

REAR AXLE ELDORADO

GENERAL DESCRIPTION

NOTE: The following information pertains only to the Fleetwood Eldorado.

The rear axle used on 693 series cars is a welded assembly of the beam type with a drop

center. This configuration allowed the spare tire to be stowed directly behind the rear seat. The rear wheel spindles are a press fit and bolted to the rear axle assembly.

Tapered roller bearings are used in the rear wheels.

SERVICE INFORMATION

NOTE: The service information that follows pertains to only the Fleetwood Eldorado. For service procedures not given, refer to the forward portion of the appropriate subsection as these procedures are the same as for the other 1969 Cadillac models.

CAUTION: If any mispositioning, incorrect assembly, or failure of components in the area of the brake system pipes, hoses, or cylinders is observed, be sure to check for any brake damage that may have resulted from such a condition and correct as required. Components that could damage the brake system due to mispositioning, incorrect assembly or failure include the exhaust system, shock absorber, springs, suspension control arms, stabilizer bar, power steering pump hoses and transmission cooler pipes.

37. Rear Wheel Bearing Adjustment

Regularly scheduled rear wheel bearing repacking is not required. When major brake service is being performed, however, it is recommended that the rear wheel bearings be cleaned and repacked with a high melting point grade 2 Lithium grease.

Adjustment of the rear wheel bearings should be made while revolving the wheel at least three

times the speed of nut rotation when taking the torque readings.

1. Check to make sure that hub is completely seated on wheel spindle.

2. While rotating wheel assembly, tighten spindle nut to 30 foot-pounds using a 0-50 foot-pound torque wrench. Make certain all parts are properly seated and that threads are free.

3. Back off spindle nut one quarter turn (90°), and install cotter pin.

NOTE: If cotter pin cannot be installed in either of the two available holes in the spindle with nut in the above position, loosen spindle nut until cotter pin can be installed.

4. Peen end of cotter pin over sufficiently against side of nut. Cotter pin must be tight after installation, if it can be moved with finger, vibration may cause it to wear and break.

38. Rear Hub

a. Removal

1. Raise rear of car and remove rear wheel.
2. Remove rear brake drum.
3. Remove dust cap, cotter pin, spindle nut, washer and outer cone and roller assembly, Fig. 4-35.
4. Carefully pull hub off of spindle.

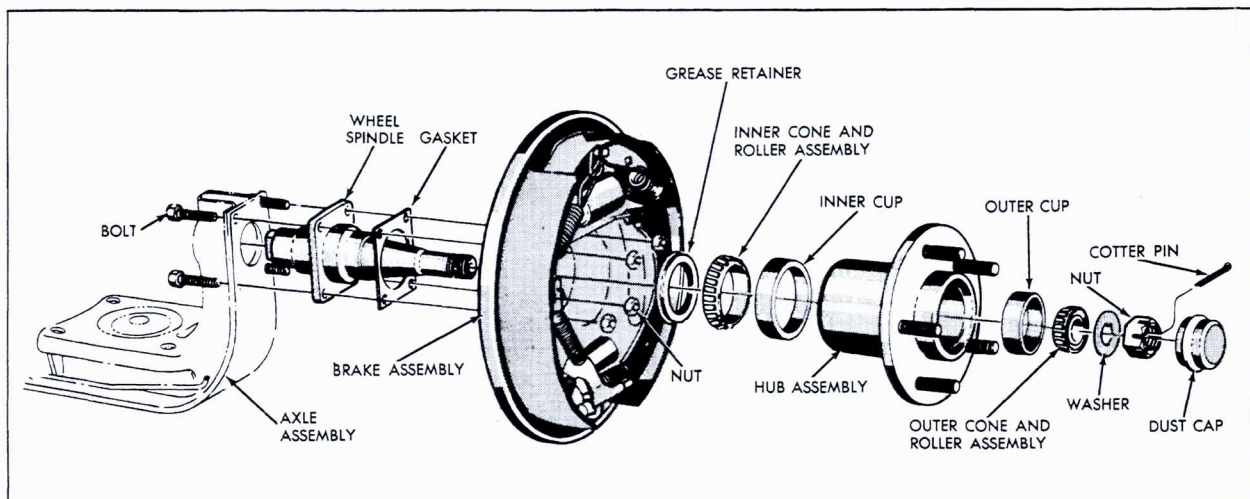


Fig. 4-35 Rear Wheel Disassembled

b. Installation

1. Install rear hub on spindle, after wiping any accumulated grease from spindle, leaving only a light film.
2. Install outer cone and roller assembly and washer over spindle into hub, and install spindle nut finger-tight.
3. Install rear brake drum and wheel.
4. Adjust rear wheel bearing as described in Note 37.
5. Check and, if necessary, adjust rear service brakes.
6. Install dust cap and wheel disc and lower car.

39. Rear Wheel Bearings and Grease Retainer (Fig. 4-35)

a. Removal

1. Remove hub assembly as described in Note 38a.
2. Pry grease retainer from inner side of hub.

NOTE: The inner bearing grease retainer tool, Section 3, Fig. 3-27, may be used to remove the grease retainer.

3. Remove inner cone and roller assembly from hub.
4. Inner and outer bearing cups are press fitted in hub, and can be removed, if necessary, by driving out from opposite side with a brass drift.

b. Inspection

1. Thoroughly clean all parts in clean solvent.
2. Check bearings for cracked separators and worn or pitted rollers.
3. Check bearing races for cracks, scores or a brinelled condition.

NOTE: Discolored stripes on bearing races of new cars do not necessarily indicate a rough bearing race.

c. Installation

1. If inner bearing cup was removed, drive or press cup, small I.D. side first, into inner side of hub, using Universal Handle, J-8092, and Inner Bearing Cup Installer, J-8458.
2. If outer bearing cup was removed, drive or press cup, small I.D. side first, into outer side of hub, using Universal Handle, J-8092, and Outer Bearing Cup Installer, J-8849.
3. Pack bearing cage with high melting point grade 2 Lithium grease. Use a commercial bearing packer or pack bearings by hand, forcing grease in at large end of cage until it protrudes from the small end.
4. Install inner cone and roller assembly into inner side of hub.
5. Drive or press new grease retainer into inner side of hub, using Universal Handle, J-8092, and Grease Retainer Installer J-8456.

6. Wipe spindle clean and apply a thin film of wheel bearing grease to spindle.

7. Install rear hub as described in Note 38b.

40. Rear Wheel Spindle (On-Car)

a. Removal

1. Raise rear of car and place on jack stands at rear frame pads.
2. Remove rear hub as described in Note 38a.
3. Disconnect service brake line fitting at wheel cylinder.
4. Remove four nuts and bolts securing brake backing plate to spindle.
5. Remove brake backing plate from wheel spindle and place backing plate out of the way.
6. Place jack under rear axle.
7. Remove four nuts from center spring clamp assembly, and lower rear axle until spindle is accessible.
8. Remove lower spring insulator from rear axle.
9. Drive spindle out of rear axle.

b. Installation

1. Start new spindle, with keyway up, into axle and install four backing plate-to-spindle nuts.
2. Progressively tighten nuts until spindle is fully seated and then remove attaching nuts and bolts.
3. Position lower spring insulator on rear axle.
4. Position rear axle to center spring clamp, making sure that spring aligning pin locates into axle, lower insulator is properly positioned and that center spring clamp bolts engage rear axle mounting holes.
5. Install four nuts securing rear axle to center spring clamp, tightening to 30 foot-pounds.
6. Install new gasket on wheel spindle.
7. Install brake backing plate on spindle and secure with four attaching nuts, tightening nuts to 40 foot-pounds.
8. Connect brake line fitting to wheel cylinder, tightening fitting to 14 foot-pounds.
9. Install rear hub as described in Note 38b.

41. Rear Axle

a. Removal

1. Raise rear of car, and place on jack stands at rear frame pads ahead of rear wheel opening.
2. Remove rear wheels.
3. Remove rear hub assemblies as described in Note 38a.
4. Disconnect brake lines at wheel cylinders.
5. Disconnect parking brake cable at equalizer.
6. Disconnect rubber brake hose at underbody connector.
7. Disconnect overtravel lever link from bracket on rear axle.
8. Remove spring guides that hold parking brake cable to center spring clamp.

9. Remove four nuts that hold brake backing plates to spindles and remove backing plates, if rear axle is being replaced.

10. Supporting rear axle at center with a hydraulic jack, remove eight nuts, four each side, from center spring clamp assemblies.

11. Lower jack and rear axle and remove rear axle from car.

12. Remove lower spring insulators from rear axle. If rear axle is being replaced proceed as follows:

- a. Remove bolt securing brake line junction fitting to axle.
- b. Remove four clips securing brake lines to axle, and remove brake line assembly.
- c. Remove bolt securing overtravel level link bracket to axle and remove bracket, if car is so equipped.
- d. Drive spindles from axle. Brace axle end being driven to reduce axle movement.
- e. Remove rubber bumpers from top of rear axle.

b. Installation

1. If step 12 in removal procedure was performed, proceed as follows:

- a. Insert spindles with keyway up, into rear axle. Using backing plate attaching bolts and nuts, progressively tighten nuts until spindle is fully seated. Remove nuts.
- b. Position brake line assembly to rear axle and install bolt securing brake line junction fitting to rear axle.

c. Install four clips securing brake lines to rear axle.

d. Position overtravel lever link bracket to axle and secure with bolt.

e. Install rubber bumpers on top of rear axle.

2. Position lower spring insulators on rear axle.

3. Place rear axle on hydraulic jack and, with the aid of a helper, position rear axle to car. Make certain that center spring clamp bolts engage rear axle mounting holes.

4. Install eight nuts, four each side, securing rear axle to center spring clamp. Tighten to 30 foot-pounds.

5. Remove hydraulic jack.

6. Install new gasket on spindle.

7. Position brake backing plates to spindle and install four nuts and bolts securing backing plates to spindle, tightening to 40 foot-pounds.

8. Connect brake lines to wheel cylinders, tightening to 14 foot-pounds.

9. Install hub assemblies as described in Note 38b.

10. Connect rubber brake hose at underbody connector, tightening fitting to 30 foot-pounds.

11. Install spring guides that hold parking brake cable to center spring clamp.

12. Connect parking brake cable at equalizer, adjusting parking brake as described in Section 5, Note 39.

13. Install overtravel lever link to bracket on axle, if car is equipped with Automatic Level Control.

14. Bleed brakes as described in Section 5, Note 10.

15. Remove jack stands and lower car.

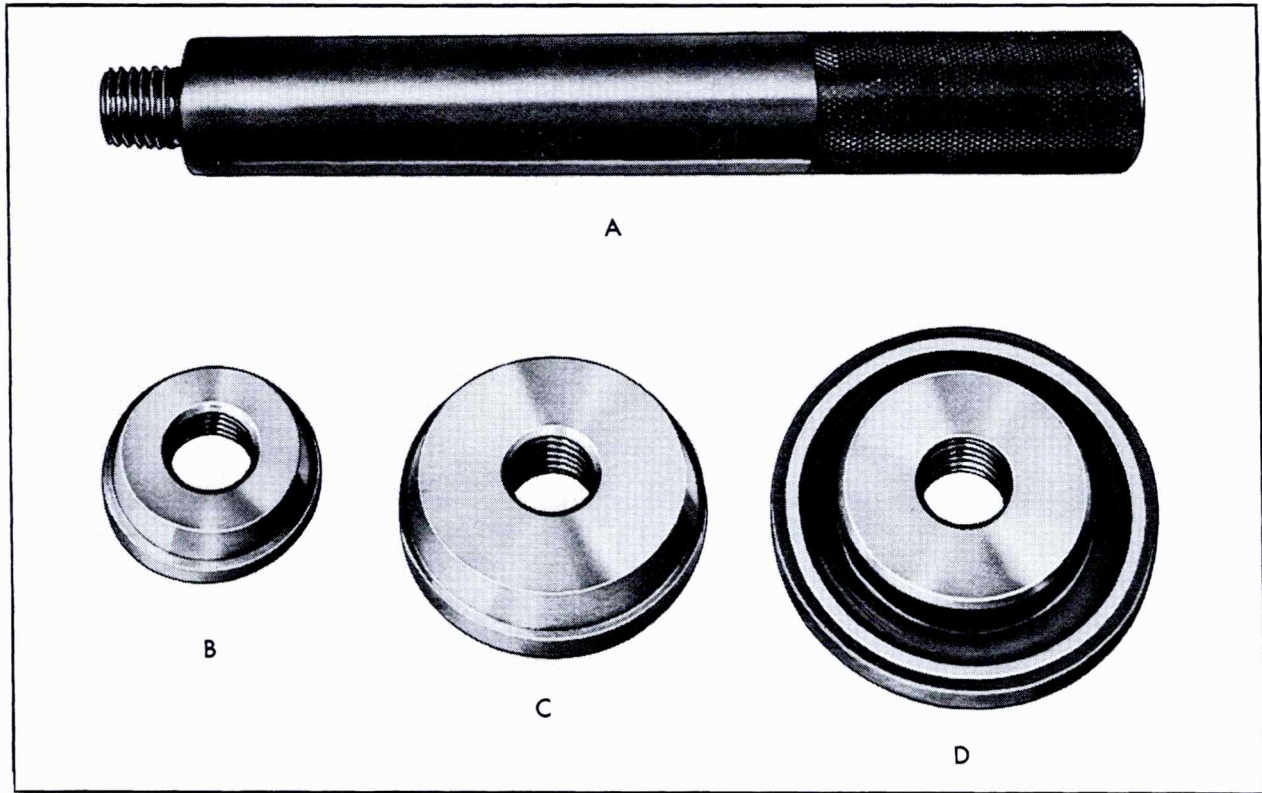


Fig. 4-36 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-8092	Universal Handle	C	J-8458	Inner Bearing Cup Installer
B	J-8849	Outer Bearing Cup Installer	D	J-8456	Grease Retainer Installer

GENERAL DESCRIPTION

NOTE: The following information is not applicable to the Fleetwood Eldorado.

The standard differential carrier and rear axle assembly, Fig. 4-37, is used on all 1969 model conventional-drive Cadillac cars. A Controlled Differential carrier is available as an extra cost option on all 1969 model conventional drive Cadillac cars.

A double lip differential carrier pinion oil seal is used on both type carriers. The seal case is of one piece flangeless construction with a double lip sealing element. The outer lip serves to keep dirt and water from the oil sealing member.

The differential carrier has a flange for attachment of the propeller shaft rear universal joint. Also, it incorporates a bolted-on differential carrier nose bumper arm, except on 698 series cars, that extends over the rear universal joint. The arm limits the axle wind-up by contacting a bumper on the underbody.

Controlled Differential

The basic advantage of the optional Controlled Differential over the standard differential is that the major driving force is always directed to the wheel having the greater traction. The unit is not a positive lock type. It will release before an excessive amount of torque is directed to one rear wheel.

The main purpose of the Controlled Differential

is to reduce the possibility of the car getting stuck while driving under slippery conditions. It also minimizes wheel spin and resultant drive line shock when accelerating on an uneven road surface.

During normal driving and cornering, the Controlled Differential unit functions as a standard differential. When one wheel encounters a slippery surface, however, the Controlled Differential allows the wheel with the greater traction to drive the car.

Wheelspin can occur if over-acceleration is attempted. However, the major driving force will still be directed to the other wheel. This condition does not indicate failure of the unit.

When checking the runout of rear wheels on cars equipped with a Controlled Differential, be sure to raise both rear wheels off the ground. Otherwise, the wheel in contact with the ground will drive when the opposite wheel is raised and rotated.

Use only the special lubricant available from Servicing Parts Warehouses on cars equipped with the Controlled Differential to assure satisfactory operation of this unit.

Use of other types of lubricants, including some that are specified by their manufacturer as "for use in all limited slip differentials", may cause a chatter or other noise . . . even when added to the factory-installed lubricant in small amounts.

All service information in this section applies

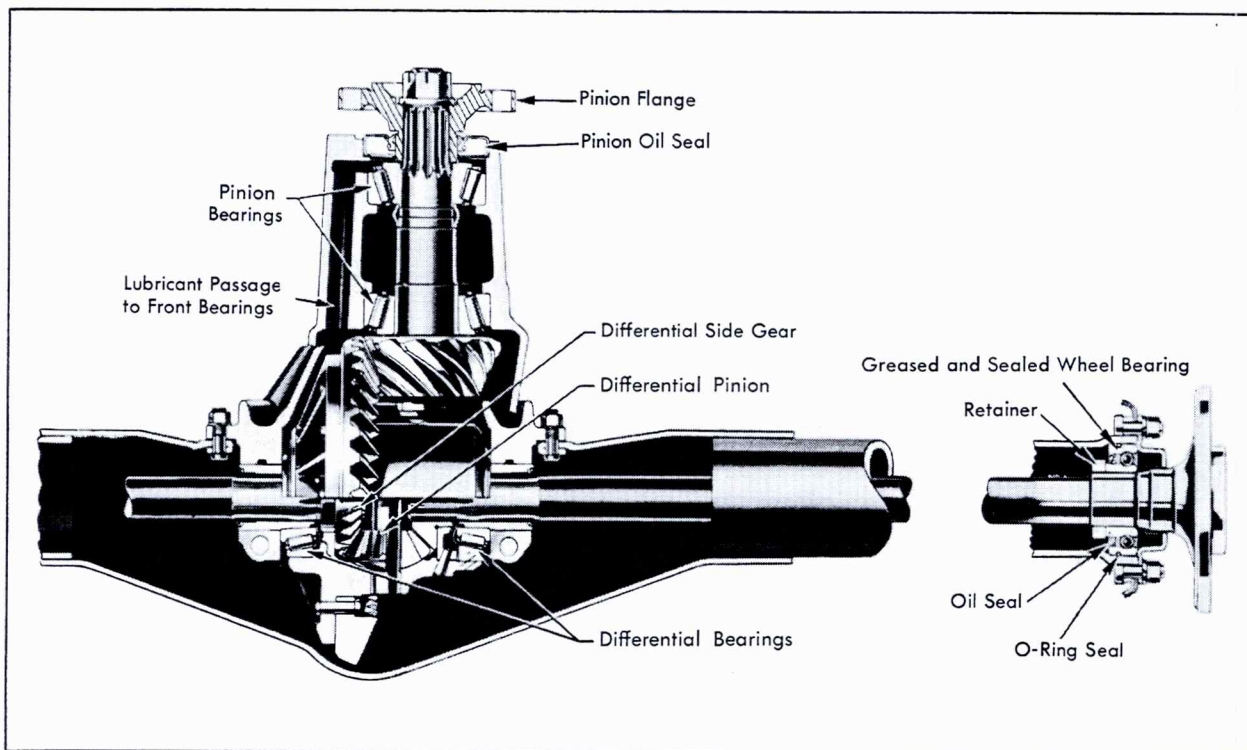


Fig. 4-37 Differential Carrier and Rear Axle Assembly

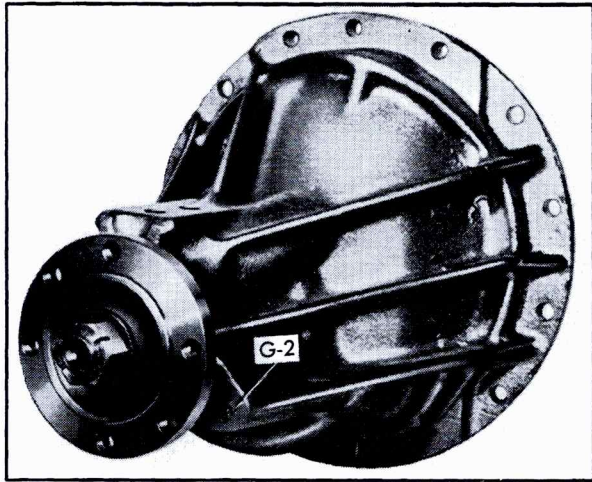


Fig. 4-38 Differential Carrier

to the controlled as well as the standard differential carrier assemblies, unless otherwise noted.

All differential carriers are serviced only as assemblies, with the exception of the pinion flange and seal.

Differential Carrier Gear Ratios

The differential carrier gear ratios used on the different series cars provide maximum performance and economy for each series.

The gear ratio of the rear axle assembly on 1969 Cadillac cars can be determined by an identification number stamped on the front face of the carrier assembly at the end of the oil return passage, Fig. 4-38.

In the case of a Controlled Differential, the letter "G" precedes the differential carrier identification number. For example: "G-2" is a Controlled Differential with a gear ratio of 2.94-1.

The gear ratios and corresponding identification numbers for the various series are as follows:

Series	Ratio	Identification Number*
1969 - 680, 681, 682, and 683	2.94 - 1	2
1969 - 697 and 698	3.21 - 1	1
*Letter "G" preceding the identification number indicates a Controlled Differential.		

SERVICE INFORMATION

NOTE: The following information is not applicable to the Fleetwood Eldorado.

42. Differential Carrier Pinion Flange and Oil Seal

CAUTION: Preload should be checked on cars with less than 500 miles and should not exceed 45 inch pounds.

When replacing the differential carrier pinion flange or oil seal, follow the procedure outlined below. Failure to do so may result in overloaded pinion bearings or drive pinion end play.

a. Removal

1. Place transmission selector lever in park. Raise rear end of car, and remove both rear wheels and brake drums to eliminate drag when measuring torque readings.

2. Remove two attaching screws and lock-washers that secure differential carrier nose bumper arm.

3. Install chain to support propeller shaft as shown in Fig. 4-39. Disconnect propeller shaft from differential and secure with chain.

4. Perform steps a through d before removing pinion flange nut.

a. Scribe a line on end of pinion stem, extending down along side of stem threads, over companion flange nut and onto companion flange, Fig. 4-44.

b. Punch a small mark on the line at pinion stem end and at top of nut, close to pinion stem threads.

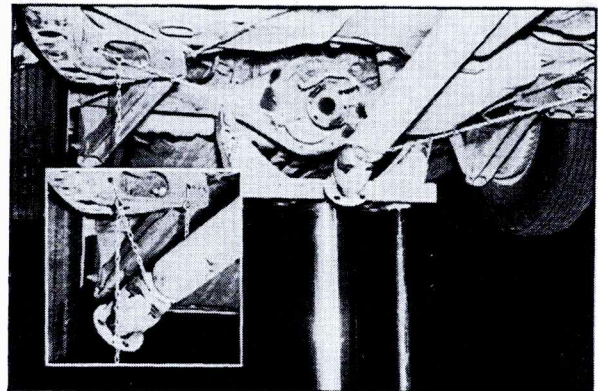


Fig. 4-39 Propeller Shaft Support Chain

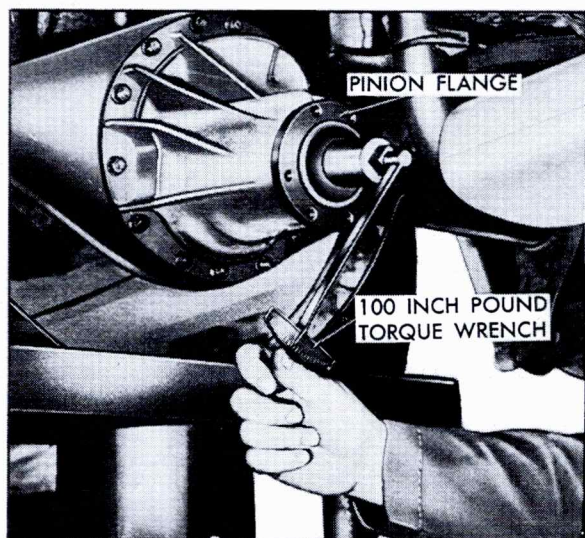


Fig. 4-40 Checking Pinion Shaft Pre-Load Torque

c. Count the number of exposed threads from top of pinion stem to nut and record.

d. Using a 0-100 inch-pound torque wrench and a 1-1/4 inch socket with a 3/4 to 1/2 inch adapter, measure the inch-pounds torque required to rotate the pinion shaft slowly for at least two turns, Fig. 4-40. Record torque reading.

NOTE: Pinion bearing preload on cars with less than 500 miles on them should not exceed 45 inch-pounds.

5. Install adapters, J-21044, on pinion flange and install pinion flange holding tool, J-8614-1, with raised side of tool against adapters, and secure with two attaching bolts.

6. Install 1-1/4 inch socket on pinion nut through hole in holding tool and remove nut and washer using a 3/4 inch drive socket wrench.

7. Install Rear Axle Pinion Flange Puller, J-8614-2, through hole in Holding Tool, index puller 45° and remove pinion flange from pinion shaft, Fig. 4-41.

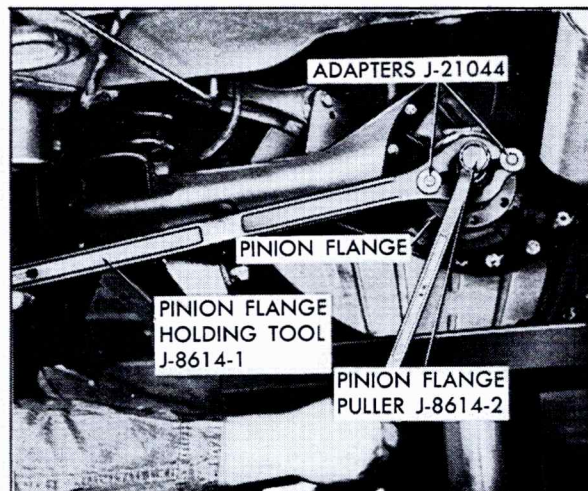


Fig. 4-41 Removing Pinion Flange

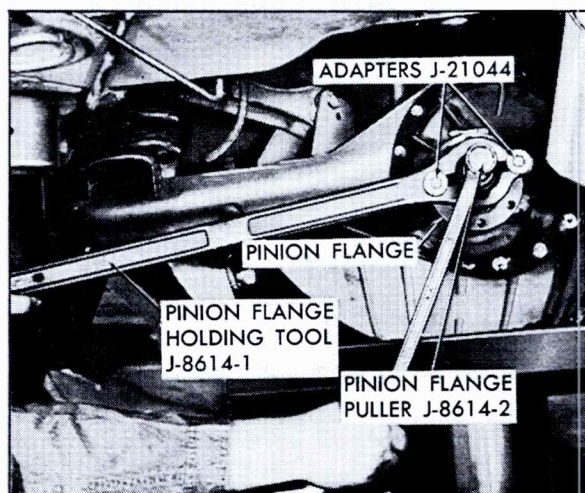


Fig. 4-42 Installing Pinion Oil Seal

8. Pry out pinion oil seal.

9. Remove staking burrs on pinion shaft threads with a small file or a 7/8 inch x 14 thread die.

b. Installation

CAUTION: Under no circumstances should pinion oil seal be hammered into position. This could result in damage to seal and possible failure of the entire unit.

1. Position oil seal in carrier. Place Oil Seal Installer, J-21113, against seal and secure tool and seal with pinion nut and washer.

2. Using 1-1/4 inch socket, 3/4 to 1/2 inch adapter and extension, press oil seal into carrier by tightening pinion nut, Fig. 4-42, until Installer Tool bottoms on face of carrier. When installed, seal case will protrude approximately 3/32 inch from machined face of carrier.

3. Remove pinion nut, washer and Oil Seal Installer, J-21113.

NOTE: Make certain that seal surface of flange is free from scratches or nicks. If necessary, clean with No. 400 grit "wet" paper and kerosene. Use only a circular motion when sanding seal surface of flange so as not to leave any spiraled marks on seal surface.

4. Install flange on pinion shaft splines with alignment marks lined up.

NOTE: If a new pinion flange, pinion nut, or both, is being installed, proceed with step 6.

5. Install washer and pinion nut on pinion shaft.

6. Install Adapters, J-21044, on pinion flange and install Pinion Flange Holding Tool, J-8614-1, on adapters, with raised side of tool against adapters, and secure with two attaching bolts.

7. Install socket on pinion nut through hole in Holding Tool and tighten nut to specification listed below, using 3/4 inch drive socket wrench, Fig. 4-43.

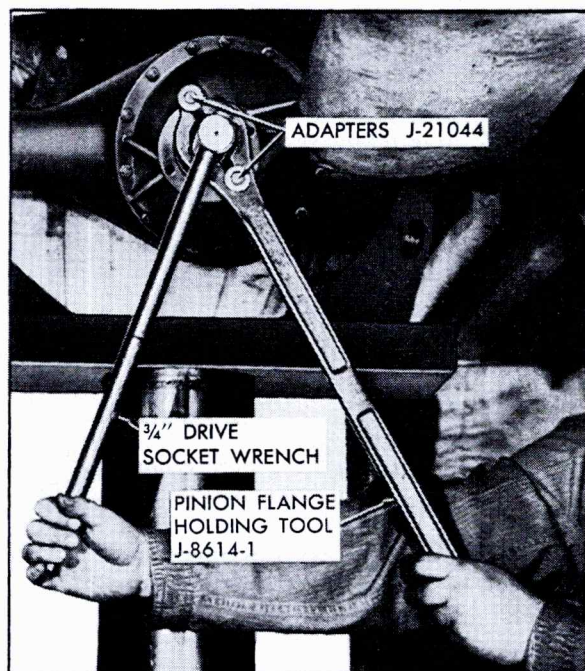


Fig. 4-43 Tightening Pinion Nut

a. If original pinion flange and pinion nut is used, make sure punch holes and scribe line are aligned, and the original number of exposed threads are exposed. After checking alignment, tighten pinion nut 1/4 flat beyond the original position.

NOTE: The pinion nut must be tightened 1/4 flat past the original position to make sure there is no end play in the pinion which would cause scoring of the gear set.

b. If a new pinion nut, pinion flange, or both is being used, tighten pinion nut to 20 inch-pounds.

If torque is low, tighten pinion nut slightly and again measure the inch-pounds torque required to rotate pinion shaft. Repeat this operation tightening the nut slightly each time, until specified torque is obtained. It will require approximately 200 foot-pounds torque on pinion nut to obtain proper bearing pre-load.

CAUTION: Do not overtighten, and never back off on the nut to reduce pre-load torque. The average torque on an assembly with over 1,000 miles is between 15 and 20 inch-pounds. The torque on a new assembly is approximately 45 inch-pounds.

8. Remove Holding Tool Adapters, J-21044, from flange.

9. Stake pinion shaft into nut.

10. Attach propeller shaft to differential with four screws and lockwashers. Tighten screws to 65 foot-pounds.

11. Install two attaching screws and lockwashers that secure differential carrier nose bumper arm.

12. Refill rear axle to correct level as described in Section 0, Note 11. Use only the special lubricant available from Servicing Parts Warehouses for cars equipped with a Controlled Differential.

13. Remove propeller shaft support chain.

14. Reinstall brake drums and rear wheels and lower car.

43. Checking Differential Carrier Pinion Flange Run-Out

1. Position car on hoist so that rear wheels will be free to rotate when car is raised.

2. Install chain to support propeller shaft as shown in Fig. 4-39. Disconnect propeller shaft from differential and secure with chain.

3. Using a wire brush, thoroughly clean differential carrier pinion flange.

NOTE: Heavy scale may have to be scraped off with carbon scraper. Inspect flange for damage or burrs. Clean propeller shaft rear flange pilot also, to ease reinstallation later.

4. Clamp Dial Indicator Set, J-8001, on nose bumper arm and position dial indicator stem to face of differential carrier between mounting bolt holes and pilot diameter, Fig. 4-44.

5. Rotate pinion flange by rotating rear wheel and note maximum face run-out indicated by dial indicator. Record reading.

6. Attach Dial Indicator Extension, J-7057, to dial indicator. Position extension against side of pilot diameter of the differential carrier pinion flange, Fig. 4-44.

7. Repeat step 5, noting and recording maximum radial run-out.

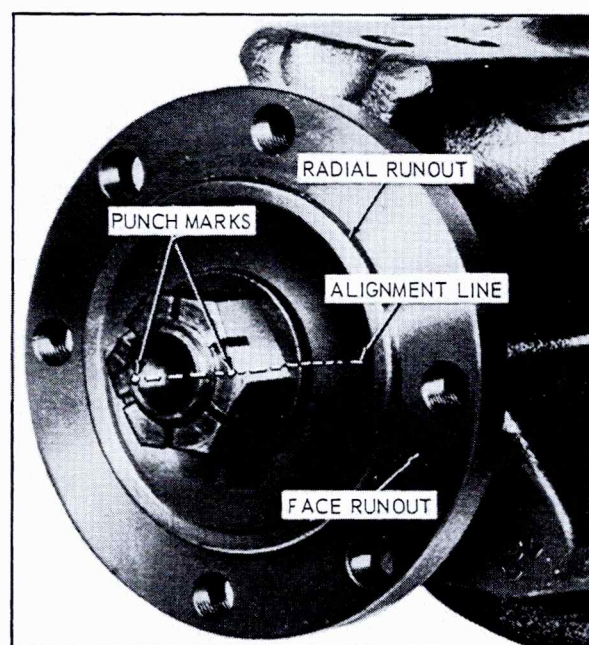


Fig. 4-44 Checking Pinion Flange Run-Out

8. If combined face and radial run-out exceeds .004 inch, remove and re-index pinion flange on the pinion shaft splines. Follow procedure described in Note 42a.

NOTE: Do not perform step 4 Note 42b.

9. Repeat steps 4 - 7. If combined face and radial runout still exceeds .004 inch, replace pinion flange, as described in Note 42b.

10. Attach propeller shaft to differential with four screws and lockwashers. Tighten screws to 65 foot-pounds.

11. Remove propeller shaft support chain.

44. Differential Carrier

NOTE: Any service on the differential carrier assembly, standard or controlled type, except pinion oil seal and flange replacement, should be handled by replacement of the complete assembly. No disassembly or adjustment of these units should be attempted in the field, as special equipment is needed for selection of mating parts and setting side bearing pre-load.

a. Removal

1. Install chain to support propeller shaft as shown in Fig. 4-40. Disconnect propeller shaft from differential and secure with chain.

2. Remove axle shafts as described in Note 36a.

3. Remove nuts and washers that hold carrier to axle housing, and remove entire assembly with gasket. Provide container for collecting oil as differential carrier is removed from axle housing.

NOTE: Whenever a carrier is removed because of scored gears, worn bearings, or any failure that might cause dirt or metal chips, clean inside of axle housing with a cleaning solvent soaked cloth, using a rod or stick to reach into tube sections of axle housing. Repeat wiping procedure with a dry cloth. Also check axle shaft assemblies and clean as necessary.

b. Installation

NOTE: On cars equipped with a Controlled

Differential, check internal splines of differential side gears and cone clutches to be sure they are aligned. This check is made by inserting axle shaft splines in each side of differential until they bottom against differential pinion shaft (approximately 4 inches).

1. Scrape any old gasket material from housing. Coat both sides of a new gasket with non-hardening sealer and place gasket on housing.

2. Position differential carrier on axle housing and install new copper washers and nuts on housing studs. Torque nuts to 40 foot-pounds.

3. Install axle shafts as described in Note 36d.

4. Fill rear axle with lubricant as described in Section 0, Note 11. If a replacement differential is installed, the special differential lubricant shipped with the new differential must be used.

5. Attach propeller shaft to differential with four screws and lockwashers. Tighten screws to 65 foot-pounds.

6. Remove propeller shaft support chain.

45. Lubricant Leaks

1. Carefully inspect differential carrier and determine location of leak.

a. If leak appears to be between differential carrier and axle housing mounting flanges, proceed to step 2.

b. If leak occurs at one of the differential carrier-to-axle housing nuts, proceed to step 4.

2. Check to make certain that nuts are tightened to 40 foot-pounds.

3. If leak continues, install an extra gasket, using a non-hardening sealer.

4. Remove nut and washer and inspect casting. If there are nicks, grinding marks or roughness, proceed to step 6.

5. If casting finish is unblemished, install new copper washer and tighten nut to 40 foot-pounds.

6. Install a 3/8-24 serrated flanged nut. Part No. 1486645, and torque to 40 foot-pounds.

7. Loosen nut and repeat torque operation ten times to mill face smooth.

8. Remove serrated flanged nut, and install a new copper washer and a new serrated flanged nut, tightening to 40 foot-pounds.

SPECIFICATIONS

Item	All Styles Unless Otherwise Noted
Pinion Flange Face Run-Out and Radial Run-Out (Combined) . . . . .	.004" Maximum
Gear Ratio	
680, 681, 682 and 683	2.94 - 1
697 and 698	3.21 - 1

TORQUE SPECIFICATIONS

Material No.	Application	Size	Foot-Pounds
286-M	Differential Carrier to Axle Housing Nuts	3/8-24	40
286-M	Pinion Shaft Nut	7/8-14	Note 42b, Step 7
300-M	Differential Carrier Nose Bumper Arm	7/16-14	50
300-M	Pinion Flange to Universal Joint Flange Attaching Screws	7/16-20	65

NOTE: Refer to back of Manual, Page 16-1 for bolt and nut markings, and steel classifications.

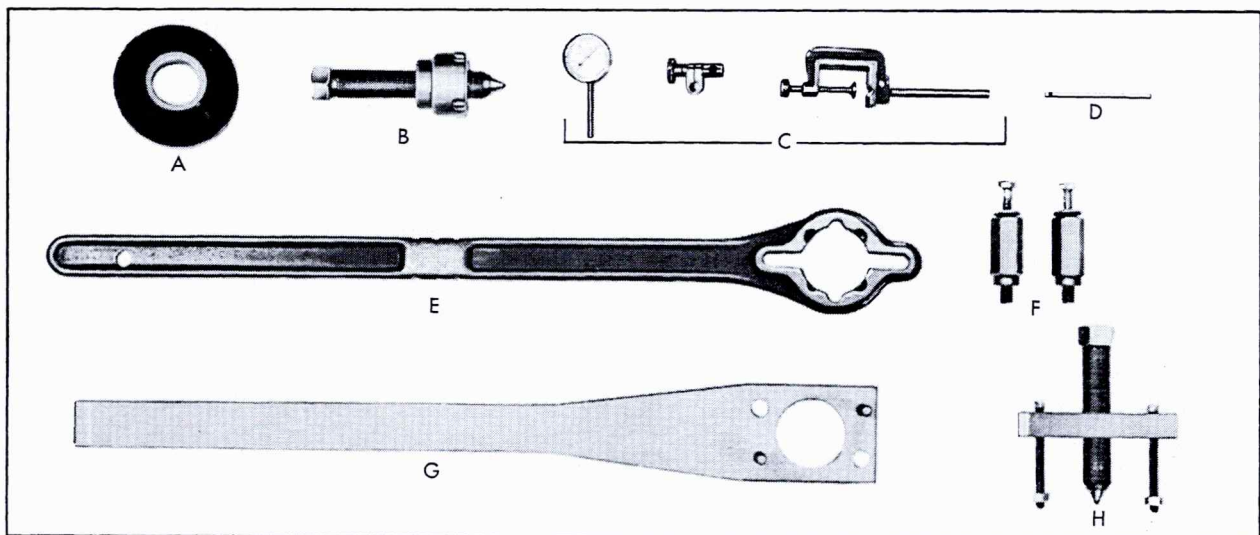


Fig. 4-45 Special Tools

Key	Tool No.	Name	Key	Tool No.	Name
A	J-21113	Pinion Oil Seal Installer	E	J-8614-1	Pinion Flange Holding Tool
B	J-8614-2	Rear Axle Pinion Flange Puller	F	J-21044	Adapter (2 required)
C	J-8001	Dial Indicator Set	G	J-6544	Pinion Yoke Holding Tool
D	J-7057	Dial Indicator Extension	H	J-6295-01	Rear Axle Pinion Yoke Puller

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GENERAL DESCRIPTION

NOTE: For information pertaining to the Fleetwood Eldorado brake system, refer to the later portion of this section.

The braking system used on 1969 Cadillac cars consists of power-assisted, hydraulically-operated front and rear service brakes and a foot-operated, vacuum-released parking brake that applies the brake shoes at the rear wheels through mechanical linkage.

Single piston sliding caliper front disc brakes and rear drum brakes are installed on all cars.

Power Brake Unit Usage and Identification

Two power brake units are used in 1969 production. A Delco-Moraine single diaphragm unit is used on all cars except 693, 697 and 698 series. These models use the Delco-Moraine tandem diaphragm power brake unit.

The power brake unit consists of two main sections: a vacuum power section and a dual master cylinder. Tandem units are readily identified by the large vacuum power section.

Split-System Master Cylinder

The master cylinders of all power units are designed so that the front and rear service brakes have separate hydraulic systems. The front section of the master cylinder provides fluid for the front brakes, while the rear section provides fluid for the rear brakes. Should a leak occur in the front hydraulic system, the rear brake system will still function. Likewise, if the rear hydraulic system should develop a leak, then the front system would still function. Increased brake pedal travel and an instrument panel brake light warns the driver that such a condition may have occurred.

Delco-Moraine Single Diaphragm Power Brake Unit

The vacuum power section of the Delco-Moraine single diaphragm power brake unit Fig. 5-1, utilizes the differential pressure created by engine intake manifold vacuum and atmospheric pressure to provide power assisted application of the hydraulic service brakes. The unit consists of a front and rear shell, a power piston assembly that houses the control valve assembly and reaction mechanism, a vacuum power diaphragm, and a power piston return spring. The control valve assembly consists of a single poppet with a filtered atmospheric port and a vacuum port.

The reaction mechanism, which is integral with the power piston assembly, controls the degree of power brake application or release in accordance with pressure applied to the valve operating rod

through the brake pedal linkage. The reaction mechanism consists of a reaction plate and levers.

A vacuum check valve at the inlet to the power unit permits several applications of the brakes with vacuum assist after the engine has stopped or after any other loss of vacuum supply. When the vacuum stored in the unit is completely used, or in case of vacuum failure at the unit, the brakes can be applied in the conventional manner, but more effort is required due to the loss of power assist.

The hydraulic unit is completely sealed from the atmosphere by rubber seals in the master cylinder reservoir. Atmospheric pressure acts on one side of the diaphragm type seal and reservoir fluid pressure on the other side. This arrangement permits the seal to follow the level of the brake fluid and prevents moisture absorption or dust contamination.

Delco-Moraine Tandem Diaphragm Power Brake Unit

The Delco-Moraine tandem diaphragm power brake unit used on 693, 697 and 698 series cars consists of a tandem diaphragm vacuum power section and a dual hydraulic master cylinder.

The design of the master cylinder is basically the same as that used on the single diaphragm unit described previously.

The tandem diaphragm vacuum power unit has a vacuum power chamber that consists of a front and rear shell, a housing divider, front and rear diaphragm and plate assemblies, a hydraulic push rod, and a diaphragm return spring, Fig. 5-2.

The unit operates so that the two diaphragm and plate assemblies utilize the differential pressure created by engine intake manifold vacuum and atmospheric pressure to assist the hydraulic push rod.

The tandem units used on 697 and 698 series cars utilize a mounting spacer and gasket. No other differences exist between this unit and the tandem unit described in the Fleetwood Eldorado Section.

Rear Drum Brakes

The rear drum brake systems consist of brake shoes (two per wheel) with riveted composition linings acting on cast iron-steel brake drums. The linings are forced against the drums by hydraulic pressure for normal braking and by a foot lever, through a mechanical linkage to the brake shoes, for the parking brake.

The wheel cylinder pistons are made of lubricant-impregnated sintered iron to resist corrosion and sticking. A metal expander is used in each piston cup to reduce the possibility of air entering the system during the application and release of the service brake.

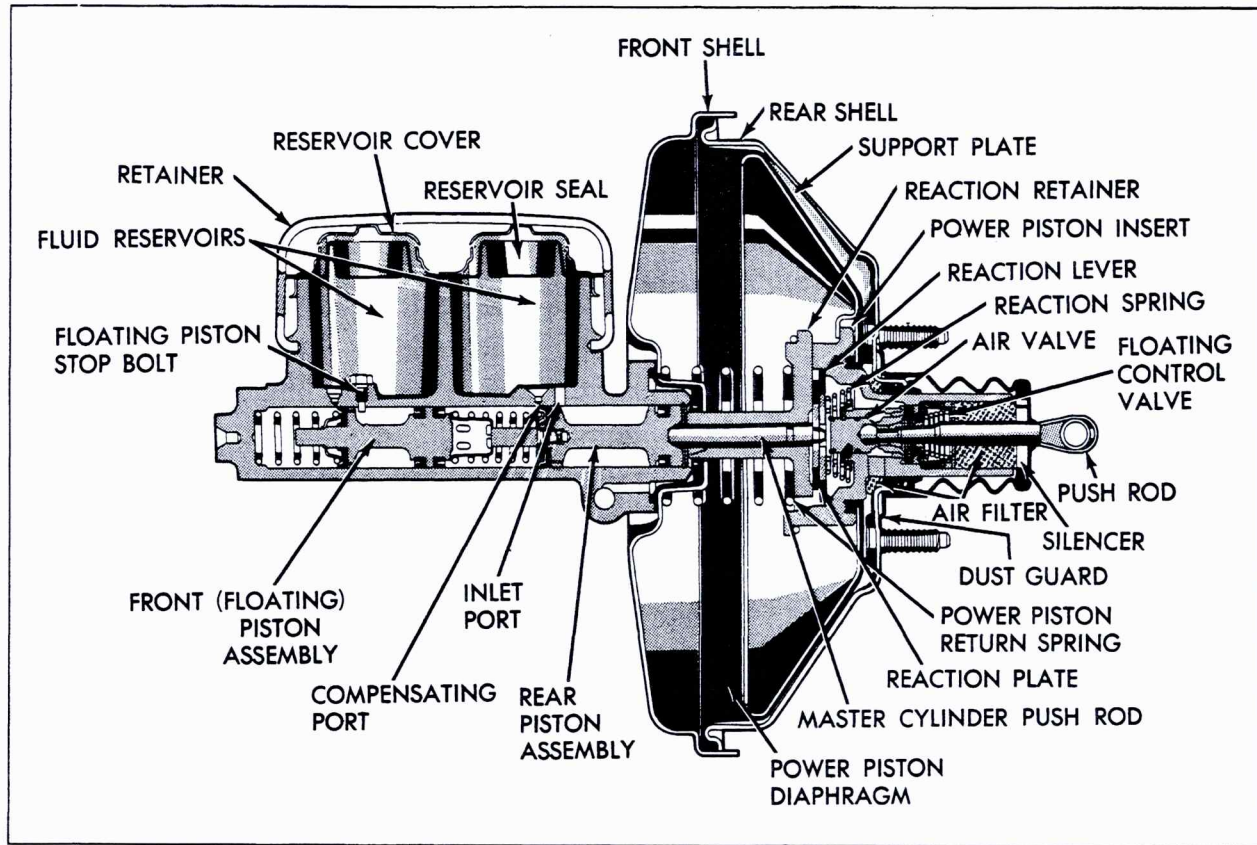


Fig. 5-1 Delco Moraine Single Diaphragm Power Unit

The brake linings are positioned in relation to the brake drums by a stationary non-adjustable anchor on each brake assembly and self-adjusting shoe mechanism. This mechanism and the precision-located anchor provide efficient braking and correct lining-to-drum clearances at all times.

The automatic adjusters can engage when the brakes are applied while the car is moving rearward with light pedal application, or after an uphill stop. Adjustment actually occurs only when there is excessive clearance between the lining and the drum.

The star wheel adjuster assemblies incorporate spring steel thrust washers between the adjusting screw and the adjuster end cap. These washers provide a spring-cushioned contact between the primary and secondary brake shoe, thereby absorbing vibrations that could cause squeak when the brakes are applied.

The brake linings are riveted to the shoes. The primary linings are grooved at the center to permit dissipation of heat from the surface of the brake drum, resulting in better brake performance and longer lining life.

Finned, cast iron-steel brake drums are used on the rear wheels to provide maximum cooling.

The parking brake pedal assembly is mounted on the cowl to the left of the service brake pedal. The parking brake will release automatically

when the transmission selector lever is moved into any drive position with the engine running. It will not release automatically, however, with the engine running and the selector lever in Neutral or Park, or in any position with the engine off. A manual release lever, located on the inboard side of the parking brake assembly, may be used if the automatic release is inoperative or if manual release is desired at any time.

The parking brake automatic release mechanism is operated by a vacuum diaphragm assembly. When the transmission selector lever is moved into any drive position with the engine running, a vacuum valve in the neutral switch opens, evacuating air from the diaphragm assembly, which in turn disengages the locking mechanism, permitting the parking brake pedal to return to its released position by spring action.

Single Piston Sliding Caliper Front Disc Brakes (Fig. 5-3)

The major components of the single piston sliding caliper front disc brake mechanism are the hub and disc assembly, the caliper assembly, the shoe and lining assemblies, the splash shield, and the support plate. The hydraulic system used with this system also utilizes a metering valve and a distributor and switch assembly in the brake lines.

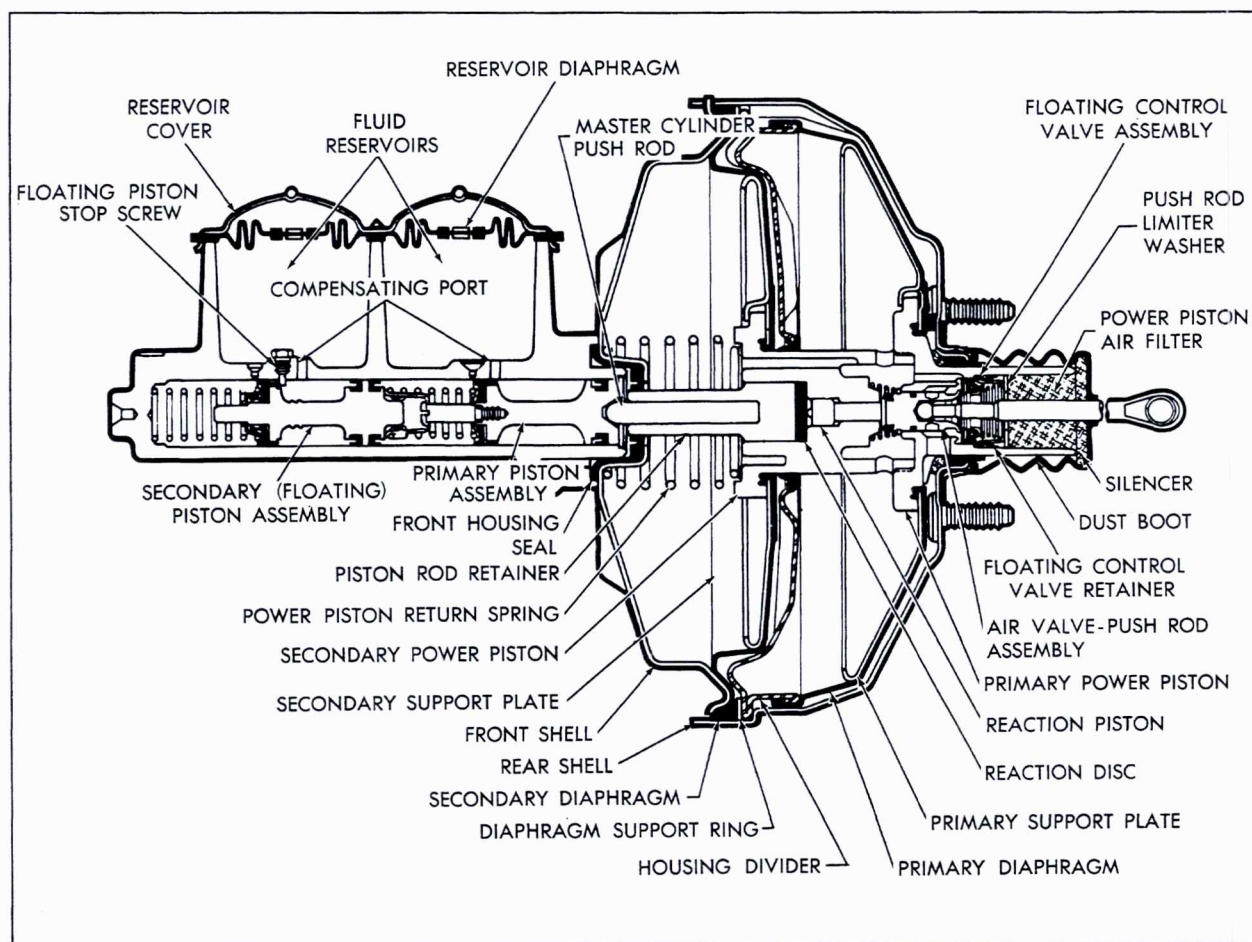


Fig. 5-2 Delco Moraine Tandem Diaphragm Power Unit

a. Hub and Disc Assembly

The cast iron disc is fully ventilated with 40 cooling fins cast integrally between the machined braking surfaces. When the wheel is in motion, the rotation of the disc fins increases the air circulation for more efficient cooling of the unit. This disc is protected from cross-car splash by a shield on the inboard side. The disc is grooved on both sides to decrease brake noise.

b. Caliper Assembly

The caliper provides a means of applying the shoe and lining assemblies to the disc. It is hydraulically connected to the system by a tube and flexible hose leading from the metering valve to each caliper inlet port. It is mounted to the support plate by two housing retainer bolts, two sleeves and four rubber bushings. An inner caliper bushing is installed between each sleeve and groove in the housing, and an outer caliper O-ring is installed between each bolt and groove in the housing. Inner and outer shoes and lining assemblies are positioned on the caliper so they straddle the disc.

The one-piece caliper housing is a malleable iron casting. It is bored for a single 2-3/4"

diameter piston. The bore is counterbored for the dust boot. The cylinder bore contains a piston and square cut seal, located in a canted groove machined in the cylinder bore. It provides a hydraulic seal between the piston and cylinder wall.

The piston is grooved to accept the molded rubber dust boot. The boot provides protection from contamination of the piston and cylinder wall. The boot inner diameter seats on a groove in the piston and the outer diameter is secured to the caliper housing counterbore by a metal ring retainer that is molded in the boot.

When the brake pedal is depressed, hydraulic pressure is exerted within the housing bore equally in all directions. In the single piston mechanism, hydraulic pressure acts on two surfaces causing them to move.

The first is the piston: the second is in the opposite direction against the bottom of the bore of the caliper housing. Since the area of the piston and bottom of the caliper bore are equal, equal forces are developed.

Hydraulic force in the bore is exerted against the piston and is transmitted to the inner brake shoe and lining assembly and the inner surface of the disc.

The disc is laterally stationary in relation to

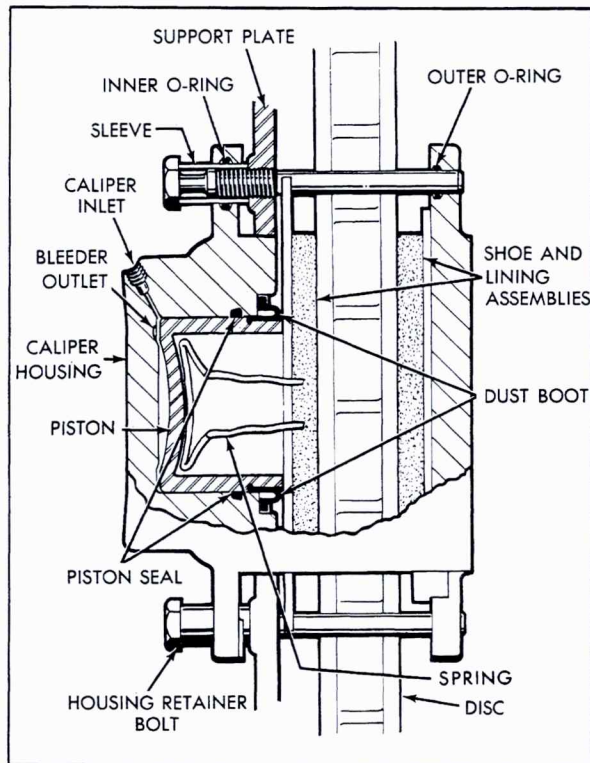


Fig. 5-3 Caliper Cut-Away View

the steering knuckle. At the same time, an equal hydraulic force presses against the bottom of the bore of the caliper housing. This tends to pull the caliper assembly inboard, sliding on the two pins. The outer lining, which rests on the caliper housing, then applies a force on the outer surface of the disc and together the two linings brake the car.

c. Metering Valve

The metering valve is located on the frame side rail extension at the left side of the car. One line connects it to the distributor and switch assembly and two other lines lead to the caliper assemblies. The metering valve delays the application of the disc brakes momentarily so that

both front and rear brakes are applied simultaneously, thereby providing a balanced braking system.

d. Distributor and Switch Assembly

A distributor and switch assembly is located on the left frame side rail behind the upper control arm. There are four lines connecting the assembly into the hydraulic system. The two front lines are connected into the front hydraulic system, with one line leading to the master cylinder front outlet port and the other leading to the metering valve. The two rear lines are connected in the rear hydraulic system, with one line leading to the rear outlet port and the other to the rear brake system.

These two systems are sealed from each other within the distributor and switch assembly. The purpose of this unit is to measure the difference between the hydraulic pressures in the front and rear brake systems. If a sufficient pressure differential exists between the systems (150 to 250 psi or more), it indicates a leak in one of them.

If this occurs, an electrical ground is made within the distributor and switch assembly. With the ignition switch on, the ground energizes the BRAKE light on the left side of the instrument cluster. This light is also energized during engine cranking for bulb and circuit checking procedures.

The brake stoplight switch is mounted on a flange on the brake pedal support bracket below the instrument panel. When the brake pedal is depressed, the spring loaded switch plunger follows the brake pedal arm downward until the switch is in the "on" position. When the brakes are released, the arm returns the switch plunger to the "off" position.

It is recommended that Delco Supreme Number 11 Super Heavy Duty Brake Fluid or its equivalent, be used in 1969 Cadillac brake systems.

Brake fluid should always be stored in closed containers, as it will absorb moisture from the atmosphere. Moisture contamination of brake fluid causes the boiling point of the fluid to be lowered.

SERVICE INFORMATION

NOTE: For service information pertaining to the Fleetwood Eldorado, refer to the latter portion of this section.

1. Manual Drum Brake Shoe Adjustment (All Except 693)

Although the hydraulic service brakes are self-adjusting, a preliminary star wheel adjustment is necessary after the rear brake shoes have been relined or replaced, or when the length of the star wheel adjuster has been changed during some

other service operation. Final adjustment is made automatically by adjusters that function when the car is moving backward. No mechanical adjustment is required when replacing front disc brake shoe and lining assemblies.

1. Check fluid level in both master cylinder reservoirs. Fluid level should be approximately 1/8 to 3/8 inches below top of reservoir. Add fluid if necessary.

2. Check to make certain that parking brake cable and linkage, including levers on rear secondary shoes, are free.

3. Tighten star wheel until brake drum can just

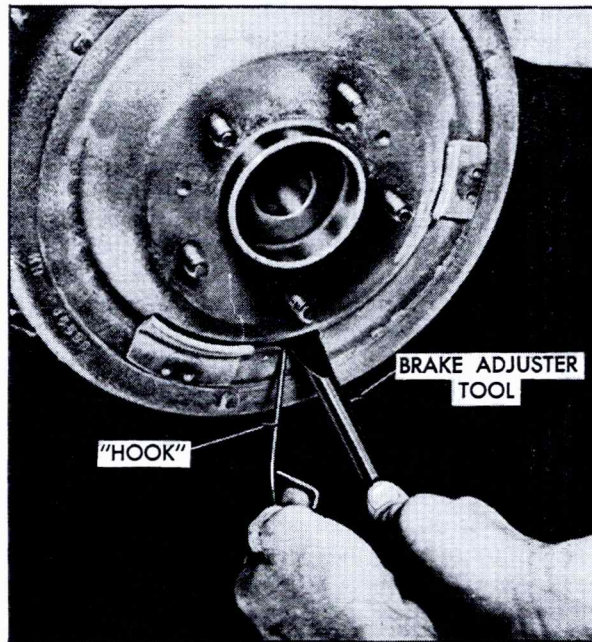


Fig. 5-4 Manual Brake Shoe Adjustment

be rotated forward with a two-foot bar placed between the studs.

4. Disengage adjuster pawl from star wheel with a hooked tool and back off star wheel 40 notches with a screwdriver or brake adjuster tool, Fig. 5-4.

5. Install wheels and lower car.

6. Drive car alternately forward and backward, applying brakes moderately in each direction until pedal travel does not exceed 1-3/4 inch on a moderate (approximately 30 pound) brake pedal application.

2. Parking Brake Adjustment (All)

NOTE: Make sure that rear drum brakes are properly adjusted before adjusting parking brake.

1. Lubricate parking brake linkage at equalizer and cable stud, and check for free movement of all cables.

2. Depress parking brake pedal approximately 1-3/4 inches from fully released position, measuring with a ruler.

3. Raise rear wheels off floor.

4. Hold brake cable stud from turning, and tighten equalizer nut, Fig. 5-5, until light drag is felt on either wheel (going forward). After each turn of equalizer nut, check to see if either wheel begins to drag.

5. Release parking brake. No brake shoe drag should be felt at either rear wheel. Operate several times to check adjustment.

NOTE: After adjustment is performed, parking brake pedal should travel 1-3/4 inches to 2-3/4 inches with approximately 50 pounds force on pedal.

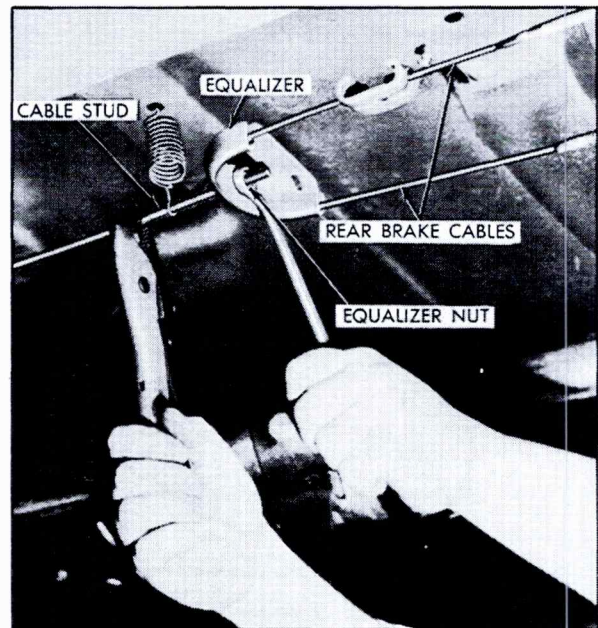


Fig. 5-5 Parking Brake Adjustment

6. Lower rear wheels.

3. Drum Brake Shoe Assemblies

When brake relining is necessary, it is recommended that the complete brake lining and shoe assemblies be replaced with new assemblies. New lining and shoe assemblies are precision-ground to fit the drum diameter, minimizing the possibility of imperfect braking action due to warped brake shoes or partial contact between linings

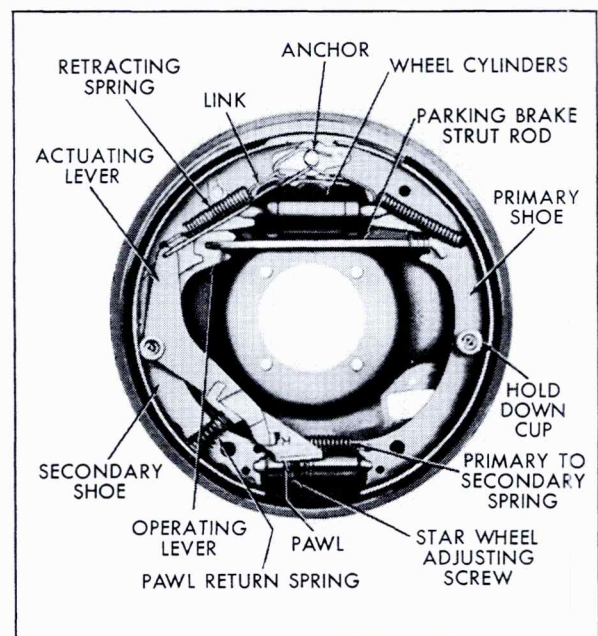


Fig. 5-6 Rear Wheel Drum Brake Mechanism

and drum. This simplifies the complete relining operation and insures a satisfactory job for the customer.

Those Service Departments that have adequate brake shoe relining equipment may obtain linings, drilled and cut to size, from their servicing Parts Distribution Center. Brake lining grinding equipment should incorporate brake shoe holders that locate the shoes accurately in relation to the anchor end, as brake anchors are not adjustable and require accurately ground linings.

4. Relining Rear Drum Brakes (All except 693) (Fig. 5-6)

1. Release parking brake, raise car, and remove rear wheels.
2. Remove rear brake drum assemblies.
3. Loosen parking brake cable locknut on equalizer.
4. Remove primary brake shoe retracting spring, using Brake Spring Remover and Installer, J-8049.
5. Disconnect link at anchor and remove link, secondary brake shoe retracting spring, and anchor plate.
6. Remove primary brake shoe hold-down cup, spring and pin, and secondary brake shoe hold-down pin, cup, spring, and sleeve.
7. Remove pawl return spring, actuating lever, and pawl.
8. Disengage brake shoes from wheel cylinder connecting links and parking brake strut rod. Remove strut rod and spring.
9. Disconnect parking brake cable from operating lever on secondary shoe and remove complete shoe and lining assembly from brake backing plate.
10. Remove star wheel adjuster and primary to secondary connecting spring from shoe assembly.
11. Remove clip from pin on secondary brake shoe and remove operating lever and pin assembly.
12. Clean brake backing plate and all brake parts.

CAUTION: To avoid the possibility of brake "grab" and "pull" after brake service has been performed, make certain that hands are clean when handling brake parts and avoid handling friction surfaces of drums and linings.

13. Tighten nuts that hold backing plate to rear axle housing to 40 foot-pounds maximum torque.

14. Install operating lever and pin assembly on replacement secondary brake shoe and secure with clip.

15. Lubricate threads and socket of star wheel adjuster and points of contact between brake and other brake parts with a heat resistant lubricant, available from Parts Distribution Warehouses. Use sparingly, especially on brake shoe pads.

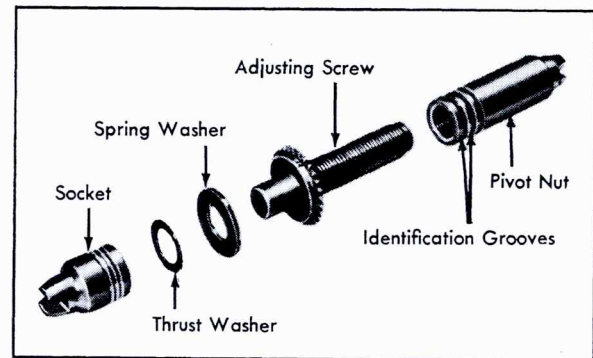


Fig. 5-7 Star Wheel Adjuster Disassembled

16. Thread star wheel adjusting screw completely into pivot nut to permit installation of brake drum over replacement brake shoes.

17. Install star wheel adjuster and primary-to-secondary connecting spring on brake shoes. Make certain that star wheel rotates in proper direction.

NOTE: Maroon springs are used on both left and right hand rear brake shoe assemblies. These springs are interchangeable.

Star wheel adjusters with three wide grooves on O.D. of pivot nut (left hand threads) Fig. 5-7, are installed on right side of car and those with three narrow grooves on O.D. of pivot nut (right hand threads) must be installed on left side.

18. Position shoe assembly on brake backing plate and connect parking brake cable to operating lever.

19. Install parking brake strut rod and spring on brake shoe assembly.

NOTE: Light blue spring is used on left side and white spring on right side. These springs are not interchangeable. Spring tab must be positioned outside of brake shoe web on both rear brakes.

20. Engage shoes with wheel cylinder connecting links and install hold-down pin, cups, and spring on primary brake shoe.

NOTE: Maroon primary and blue secondary hold-down springs are used on the rear brake assemblies.

21. Position actuating lever and pawl so that actuating lever is on top of secondary brake shoe. Secure with hold-down pin, sleeve, spring, and cup.

22. Install anchor plate, link, and secondary brake shoe retracting spring (yellow). For easiest installation, first connect spring to link, then install link on anchor, using brake Spring Remover and Installer, J-8049.

23. Install pawl return spring. Make certain that star wheel engages pawl.

24. Install primary brake shoe retracting spring (red) using Spring Installer, J-8049.

25. Install rear brake drums on rear axle shaft flange and secure with screw.

26. Perform preliminary service brake adjustment as described in Note 1.

27. Install wheels on brake drums. Tighten wheel mounting nuts to 105 foot-pounds.

28. Adjust parking brake as described in Note 2.

5. Machining Brake Drums

Brake drums should be carefully checked to see if they have become warped or scored excessively. If they appear salvageable and if suitable equipment is available, they can be machined.

Drum machining is a precision operation. Equipment used for this purpose must be capable of maintaining the close limits specified. Be sure to install drum in the machining equipment correctly and to check runout of lathe spindle to insure accuracy of final machining operation. Inside drum diameter must not be machined over 12.060 inches on all cars except the Fleetwood Eldorado or 11.060 inches on the Fleetwood Eldorado. Should brake drums be machined too thin, the intense heat that develops under severe driving conditions will cause them to distort, crack or warp.

In addition, the specifications listed on page 5-29 for all cars except the Fleetwood Eldorado or page 5-43 for the Fleetwood Eldorado must be held.

Replacement brake drums supplied by your servicing Parts Warehouses are finish-machined at the factory before being shipped. They do not require any further finishing before installation, but they must be thoroughly cleaned with a non-oil base solvent to remove all traces of the oil or

grease used for rust-proofing during storage and transit. Do not machine drums to roughen the braking surface. Use coarse emery cloth for this purpose.

6. Break-In of New Linings (All)

New or replacement brake linings, if subjected to normal usage at speeds under 50 MPH, need no special break-in. However, the first few brake applications may be somewhat erratic, and Servicemen may need to stabilize the brakes before delivering the car to the owner. If brake action is erratic, one acceptable way to seat the brakes is to make five or ten moderate brake stops at speeds of 30 to 40 MPH, at approximately one-half mile intervals.

7. Wheel Cylinder Servicing (Drum—Except 693)

a. Removal—(All Except 693)

NOTE: For Eldorado procedure, refer to Note 29.

1. Raise car and remove wheel and brake drum. Blow out dust and dirt from drum and linings.

2. Disconnect hydraulic brake piping from wheel cylinder.

3. Remove brake shoe retracting springs and link.

4. Remove two screws holding wheel cylinder to backing plate.

5. Disengage wheel cylinder connecting links from brake shoes and remove wheel cylinders.

CAUTION: Be sure brake fluid does not drip on brake linings.

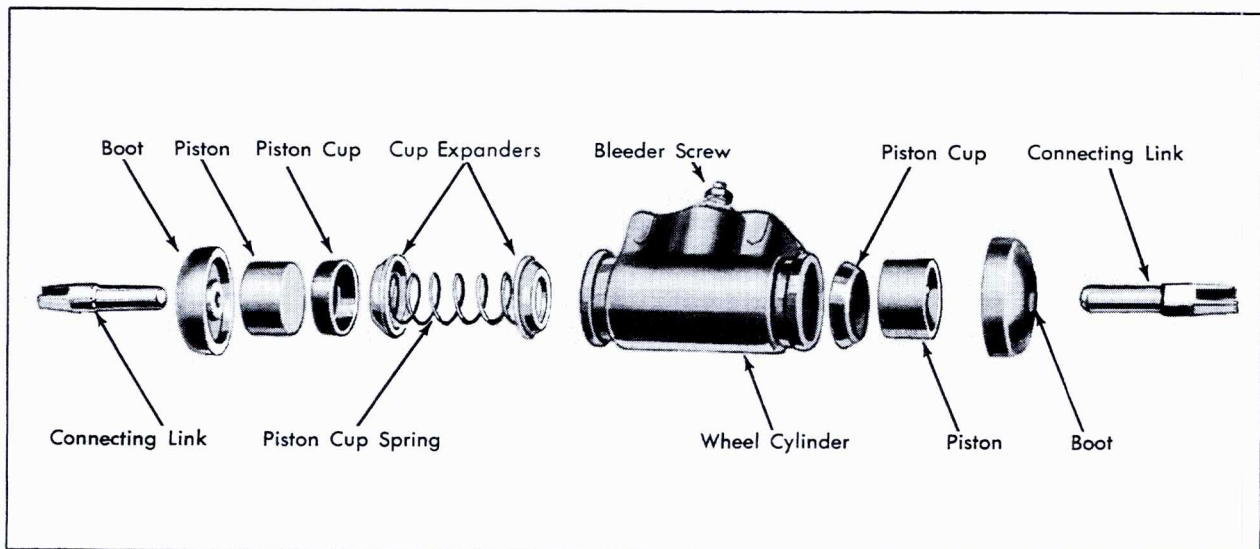


Fig. 5-8 Wheel Cylinder Disassembled

b. Disassembly (Fig. 5-8) (All)

1. Remove connecting links and rubber boots from ends of wheel cylinder.
2. Slide pistons and piston cups from either end of cylinder.
3. Remove piston cups, spring and expander assembly.
4. Remove bleeder screw assembly.

c. Cleaning and Parts Replacement (All)

With clean hands, wash all parts except pistons in clean alcohol. Wipe pistons with clean dry cloth. Inspect surface of cylinder bore and hydraulic passages. Replace wheel cylinder if any obstructions are observed in holes or if there are any nicks or burrs in bore.

If it is necessary to replace any of the wheel cylinder assembly parts, refer to parts book for replacement parts.

d. Assembly, (Fig. 5-8) (All Except 693)

NOTE: For Eldorado procedure refer to Note 29.

1. Install bleeder screw assembly.
2. Install piston cup in one end of cylinder with lip toward center, and install piston with flat side toward cup.
3. Place rubber boot over end of wheel cylinder.
4. Install spring and expander assembly.
5. Install other piston cup, lip toward center. Install piston, flat side toward cup.
6. Install remaining rubber boot over end of cylinder.

e. Installation—(All Except 693)

1. Position wheel cylinder on brake backing plate, slipping cylinder-to-shoe connecting links in place at same time.
2. Install two screws holding wheel cylinder to backing plate. Tighten to 15 foot-pounds maximum torque.
3. Install brake shoe retracting springs and link.

NOTE: Avoid handling friction surfaces of drums and linings.

4. Connect brake piping to wheel cylinders.
5. Install brake drum and wheel assembly.
6. Bleed all brakes as described in Note 8.
7. Lower car.

8. Bleeding Brakes

Bleeding brakes may be made considerably easier through use of one of the pressure brake bleeder tools available. This equipment consists of a tank partially filled with brake fluid and rubber hose that connects to the hydraulic cylinder

reservoir Bleeder Adapter Cover, J-22489-1. Air pressure is applied to the tank to force fluid into the brake system.

The Bleeder Adapter Cover, J-22489-1, seals the brake system from the atmosphere during the bleeding operation, and enables both the Delco Moraine and the Bendix brake systems to be bled with only one hook-up.

After bleeding brakes, check pedal travel as described in Note 25, part e. Rebleed or adjust brakes as necessary.

CAUTION: Always use Delco Supreme Super 11 Heavy Duty Brake Fluid or its equivalent.

Do not spill brake fluid on car finish or damage will result.

a. Pressure Bleeder Method

1. Remove master cylinder reservoir cover and seal assembly and fill both reservoirs with fluid.
2. Install Bleeder Adapter Cover, J-22489-6, on master cylinder and connect bleeder hose to Bleeder Adapter Cover. Longer cables, J-22489-12, are required when working with the tandem diaphragm master cylinder.
3. Using pliers, install Metering Valve Bleeder Retainer, J-22742, on metering valve so that knob is held open, Fig. 5-9. Bend retainer only enough to install. Excessive bending will break tool.

NOTE: On all cars except Fleetwood Eldorado, this is more easily done after car is raised. On the Fleetwood Eldorado, this valve is located on a bracket on the power unit.

4. Raise car being careful not to damage pressure bleeder equipment.
5. Build up pressure in bleeder.
6. Bleed right rear brake by attaching drain hose to bleeder fitting at wheel.
7. Back off fitting one half turn and bleed brake fluid into a partially filled bottle of clean brake fluid until bubbles stop, then close fitting.
8. Repeat steps 6 and 7 on left rear wheel.

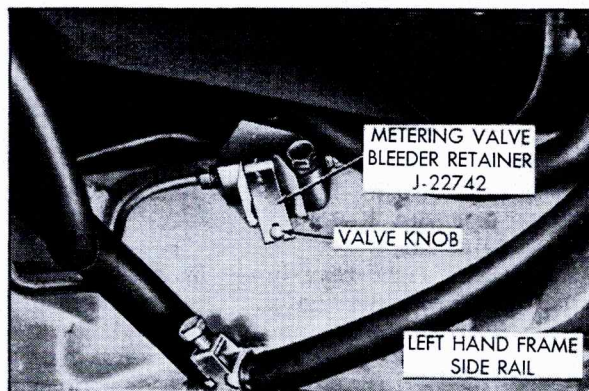


Fig. 5-9 Holding Metering Valve Open

9. Attach drain hose to bleeder fitting on right front caliper.

10. Back off fitting one half turn and bleed brake fluid into a partially filled bottle of clean brake fluid until bubbles stop, then close fitting. During the bleeding operation, tap the caliper lightly and repeatedly with a plastic-headed hammer.

NOTE: Tapping the caliper is essential on disc brakes, as air bubbles tend to cling to the wall of the caliper.

11. Repeat operation for left caliper.

12. After bleeding brakes, check pedal travel as described in Note 25, part e. Rebleed brakes if necessary.

NOTE: As indicated in procedure, brakes are bled in the following order: right rear, left rear, right front, left front. Do not re-bleed rear brakes unless necessary. Any air left in system will generally be in front brake system, in which case bleed right front and then left front brakes.

13. Remove Metering Valve Bleeder Retainer J-22742.

NOTE: On Fleetwood Eldorados, this is more easily done after car is lowered.

14. Lower car.

15. Remove pressure bleeding equipment and check reservoir level. Level should be 1/8 inch to 3/8 inch from top.

16. Install master cylinder cover and seal assembly.

17. Before driving car, be sure a firm pedal is obtained.

b. Alternate Method

If a pressure bleeder is not available the following two man procedure may be used.

1. Fill both master cylinder reservoirs with brake fluid.

NOTE: Keep reservoirs at least partially filled at all times during bleeding operation. More pedal pumping is required during this bleeding procedure than on cars with drum brakes at all wheels. The fluid level in the master cylinder reservoirs should therefore be frequently checked.

2. Back off both master cylinder outlet pipe nuts one turn and completely pump brake pedal five times, catching fluid displaced from outlets in a cloth or can. Discard this fluid and retighten outlet pipe nuts. Refill reservoirs.

3. Raise car.

4. Bleed right rear brake by attaching drain hose to bleeder fitting at wheel.

5. Apply pressure to brake pedal, back off fitting one-half turn, and depress brake pedal. Close bleeder fitting before releasing pressure on brake pedal. Repeat pedal applications until bubbles stop.

6. Repeat steps 4 and 5 on left rear wheel.

7. Attach drain hose to bleeder fitting on right front caliper.

8. Apply pressure to brake pedal, back off fitting one-half turn, and depress brake pedal. Close bleeder fitting before releasing pressure on brake pedal. Repeat applications until bubbles stop. During the bleeding operation, tap the caliper lightly and repeatedly with a plastic headed hammer.

NOTE: Tapping the caliper is essential on disc brakes, as air bubbles tend to cling to the wall of the caliper.

9. Repeat operation for left caliper.

10. After bleeding brakes, check pedal travel as described in Note 25, part e. Rebleed brakes if necessary.

NOTE: As indicated in procedure, brakes are bled in the following order: right rear, left rear, right front, left front. Do not re-bleed rear brakes unless necessary. Any air left in system will generally be in front brake system, in which case bleed right front and then left front brakes.

11. Lower car.

12. Check reservoir level. Level should be 1/8 inch to 3/8 inches from top.

13. Install master cylinder cover and seal assembly.

14. Before driving car, be sure a firm pedal is obtained.

9. Disc Brake Relining (All)

NOTE: Check lining on brakes any time wheels are removed. (Tire rotation, etc.) In-board lining may be checked by looking through inspection hole in caliper. When thickness of any lining is about the same as the thickness of the metal shoe, all shoe and lining assemblies should be replaced.

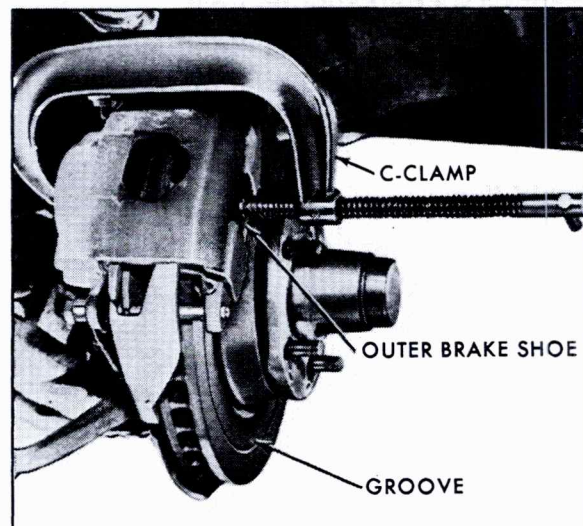


Fig. 5-10 Pushing Piston into Bore

1. Remove two thirds of the total fluid capacity in the front master cylinder reservoir. Discard fluid.

NOTE: Removing the fluid prevents reservoir overflow when the piston is pushed back in its bore to remove the caliper.

2. Raise car and remove front wheels.

3. Position 7 inch "C" clamp on the caliper so that solid side rests against back of caliper assembly. The screw end rests against back of outboard shoe, Fig. 5-10.

4. Tighten "C" clamp until caliper moves out far enough to push piston to bottom of piston bore. This will release the pressure on shoe and lining assemblies.

5. Remove "C" clamp.

6. Remove two bolts which hold caliper to support plate, Fig. 5-11.

NOTE: It is not necessary to remove brake hose when relining disc brakes.

7. Slide caliper off disc.

NOTE: Do not allow caliper to hang from brake hose. The caliper may be supported by a hook-shaped wire fastened to the upper control arm.

8. Remove inboard shoe and spring from piston.

9. Remove outboard shoe from caliper.

10. Push out two sleeves from inboard ears of the caliper.

11. Remove four rubber bushings, two on inboard ears and two on outboard ears.

12. Examine piston area for fluid leaks by looking for excessive moisture around boot area. Check dust boot for cuts, cracks or other damage which would affect its ability to seal piston bore.

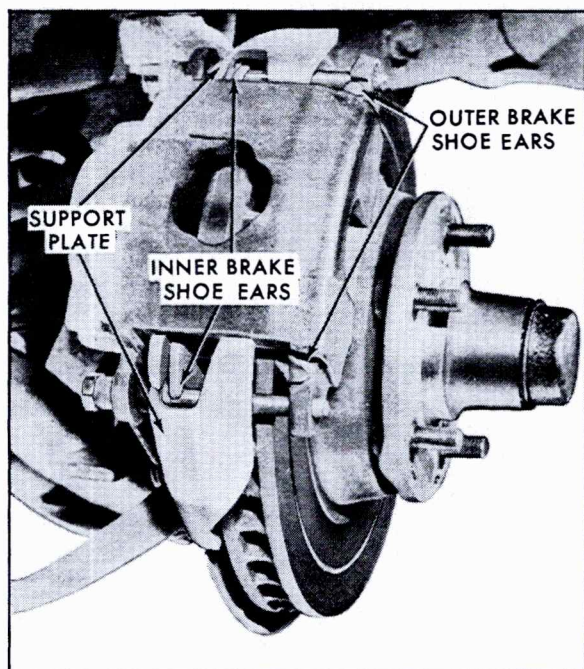


Fig. 5-11 Sliding Caliper Disc Brake

If leaks are present or boot shows damage, caliper should be overhauled as described in Note 11. If no defects are found, wipe clean the inside of the caliper including four ears where bushings are installed. Wipe the outside surface of the dust boot clear of all dirt so that when piston is pressed to bottom of bore, boot will fold back without coming out of groove in piston.

CAUTION: Do not use air for cleaning caliper because of the possibility of unseating dust boot.

13. Examine both side of disc for scoring or rough finish. Refer to Note 13 to determine condition of disc. In normal use, a slight ridge of rust may form on the edge of the disc. This ridge may be removed with crocus cloth. Machining of the disc is not recommended.

14. Make sure the piston is bottomed in the piston bore. Make sure the dust boot has folded back correctly as the piston moved back.

15. Wipe out grooves in caliper ears and install new bushings.

16. Lubricate new sleeves on outer surface with silicone lubricant. Push in two sleeves and position the sleeve so that end toward the shoe and lining assembly is flush with the machined surface or the ear.

17. Position spring inside cut-out section of piston. Install inboard shoe and lining assembly.

18. Place the outboard shoe and lining in the caliper so that the lining faces toward the disc. The two ears at the ends of the shoe fit over the ears on the caliper. The flange on the bottom of the shoe fits into the cutout section of the caliper.

19. Crimp outboard shoe ears so that they fit snugly on caliper.

20. Position caliper on disc and line up holes in caliper ears with holes in support plate. Make sure brake hose is not twisted when caliper is attached to support plate.

21. Wipe all dirt and corrosion from the caliper mounting bolts. Do not use abrasives, as they will remove protective plating. Lubricate smaller ends of bolts with silicone lubricant.

22. Start either bolt into the inboard ear of the caliper and into the support plate. At this point it is necessary to be sure that the bolt passes under the retaining ear on the inboard shoe to maintain the shoe in position in the caliper, Fig. 5-11.

23. Pass the bolt on through the outboard ear on the caliper until the threads on the bolt can be started into the mounting bracket.

24. Repeat steps 22 and 23 in placing remaining bolt into caliper assembly.

25. Tighten caliper mounting bolts to 25 to 35 foot-pounds.

26. Repeat steps 3 through 25 on other brake assembly. Always reline both front brakes.

27. Install wheels, tighten wheel mounting nuts to 90-120 foot-pounds, and lower car.

28. Before moving the vehicle, pump the brake pedal two or three times to insure firm pedal.

29. Check the master cylinder reservoirs and fill to 1/8 to 3/8 inch from top.

30. Any time the front brakes are relined, the rear drum brakes should be checked.

31. Break in new linings as described in Note 6.

10. Disc Brake Caliper Assembly (All)

a. Removal

1. Remove two thirds of the total fluid capacity in the front master cylinder reservoir. Discard fluid.

NOTE: Removing fluid prevents reservoir overflow when the piston is pushed back in its bore to remove the caliper.

2. Raise car and remove wheels.

3. Position a "C" clamp on the caliper so that solid side rests against back of caliper assembly. The screw end rests against back of outboard shoe, Fig. 5-10.

4. Tighten "C" clamp until caliper moves out far enough to push piston to bottom of piston bore. This will release the pressure on shoe and lining assemblies.

5. Remove "C" clamp.

6. Disconnect steel brake line from hose and cap fittings to prevent dirt from entering brake line or hose.

7. Remove U-shaped retainer from hose fitting and withdraw hose from frame support bracket.

8. Remove two bolts which hold caliper to support plate.

9. Slide caliper off disc.

10. Remove inboard shoe from caliper.

11. Outboard shoe may have disengaged itself from caliper as caliper was removed from disc. If it did not disengage itself, remove outboard shoe.

12. Place caliper on clean workbench and remove hose and copper washer from caliper inlet fitting. Discard washer.

13. Overhaul caliper as described in Note 11.

b. Inspection of Disc

1. With the caliper assembly off the disc, inspect disc as described in Note 13.

c. Installation

1. Connect the brake hose to the inlet hole on the caliper, using a new copper washer. Tighten to 30 foot-pounds maximum torque.

2. Make sure the piston is bottomed in the piston bore. Make sure the dust boot has folded back correctly as the piston moved back.

3. Place inboard shoe and lining in caliper such that the shoe is between shoe support spring and caliper bridge.

4. Place the outboard shoe and lining in the caliper so that the lining faces toward the disc.

The two ears at the ends of the shoe fit over the ears of the caliper. The flange on the bottom of the shoe fits into the cutout section of the caliper. Crimp outboard shoe ears down over flange of caliper.

5. Position caliper on disc and line up holes in caliper ears with holes in support plate.

6. Lubricate smaller ends of caliper bolts with silicone lubricant.

7. Start either bolt into the inboard ear of caliper and into the support plate. At this point it is necessary to be sure that bolt passes under the retaining ear on the inboard shoe to maintain the shoe in position in the caliper, Fig. 5-11.

8. Pass the bolt on through the outboard ear on the caliper until the threads on the bolt can be started into the support plate.

9. Repeat steps 7 and 8 in placing remaining bolt into caliper assembly.

10. Tighten caliper mounting bolts to 25 to 35 foot-pounds.

11. Install wheel and tighten mounting nuts to 90 to 120 foot-pounds torque.

12. With suspension in normal position (front wheels straight) pass female end of hose through frame support bracket, allowing hose to seek its own position. Insert hex of hose fitting into the 12-point hole in support bracket in position that will result in least twist in hose.

NOTE: Do not twist hose any more than necessary during this operation as its natural curvature is essential to maintain proper hose-to-suspension clearance through full movement of suspension and steering parts.

13. Install U-shaped retainer to secure hose in frame support bracket.

14. Inspect by turning steering from stop-to-stop while observing hose position. Be sure that hose does not touch other parts at any time during steering travel. If contact does occur, remove hose retainer and rotate female hose end in support bracket one or two points in appropriate direction, replace retainer, and re-inspect.

15. Place steel tube connector nut in hose fitting and tighten to 20 foot-pounds maximum torque.

16. Bleed all brakes as outlined in Note 8.

17. Before moving car, pump brake pedal two or three times to insure a firm pedal.

11. Disc Brake Caliper Disassembly, Cleaning, Inspection and Assembly (All)

a. Disassembly

1. Remove caliper assembly as described in Note 10.

2. Clean the caliper exterior with denatured alcohol.

3. Push out two sleeves from inboard ears of the caliper.

4. Remove four rubber bushings, two on inboard ears and two on outboard ears.

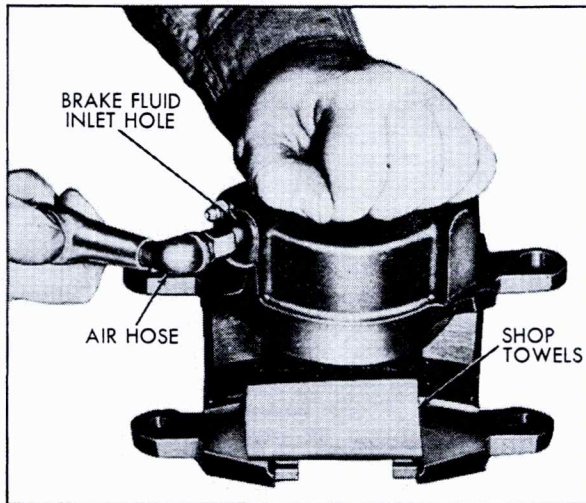


Fig. 5-12 Removing Piston

5. Place a pad of clean shop towels on caliper bridge, Fig. 5-12.

NOTE: The towels will prevent damaging the piston when it is pushed out by air pressure.

6. Use service air hose to apply moderate air pressure to brake fluid inlet hole to force piston out of caliper.

CAUTION: Use clean air only. Air supplies that are lubed or oiled contain mineral oil that will damage rubber parts.

7. Using a screwdriver, pry boot out of housing, being careful not to scratch bore, Fig. 5-13. Discard boot.

NOTE: Do not re-use boot under any conditions as any water entry will cause bore corrosion and piston sticking.

8. Using a plastic toothpick, remove piston seal from groove in bore and discard seal.

CAUTION: Do not use any metallic device to remove the seal, as it may scratch or damage the bore or groove.

9. Remove bleeder fitting from caliper assembly.

b. Cleaning and Inspection

1. Inspect the caliper brake hose for worn spots, cracks or other signs of deterioration. Replace if necessary.

2. Inspect the piston for scoring, pitting, nicks, corrosion and worn or damaged chrome plating. If any of these faults appear, it will be necessary to replace the piston.

3. The bore should be inspected for the same defects as the piston with the exception of chrome plate. Stains or corrosion can be polished with fine crocus cloth. Wash caliper bore with clean denatured alcohol. If the defects cannot be cleaned up in this manner, it will be necessary to replace the caliper.

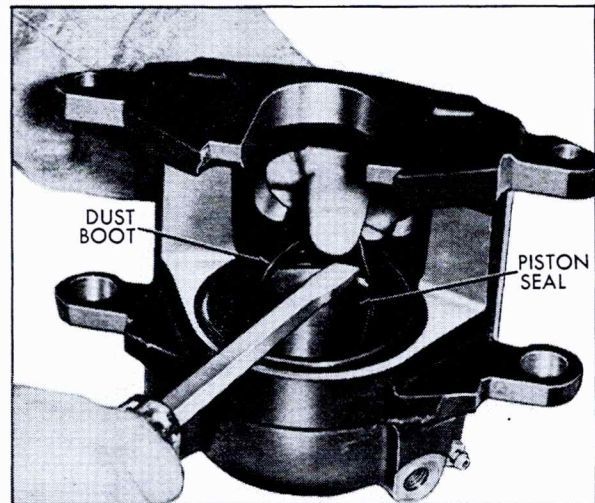


Fig. 5-13 Removing Dust Boot

4. All passageways should be blown out with clean air.

5. Clean the caliper mounting bolts and caliper ear grooves of all dirt and corrosion. Do not use abrasives on bolts, as they will remove protective plating.

c. Assembly

1. Install bleeder fitting in caliper.

2. Lubricate piston bore and new piston seal with brake fluid.

3. Position the new seal in the groove in the piston bore.

4. Assemble new dust boot on piston, so that inner diameter of boot is secured in groove and boot fold faces away from closed end of piston, Fig. 5-14.

NOTE: Do not use previously removed boot.

5. Lubricate sealing surface of piston with brake fluid. Position piston in bore and press it down to bottom of bore. Make certain dust boot does not disengage from groove in piston.

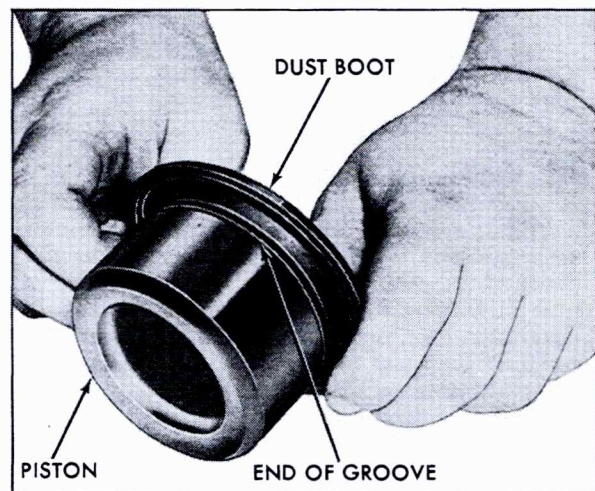


Fig. 5-14 Assembling Dust Boot on Piston

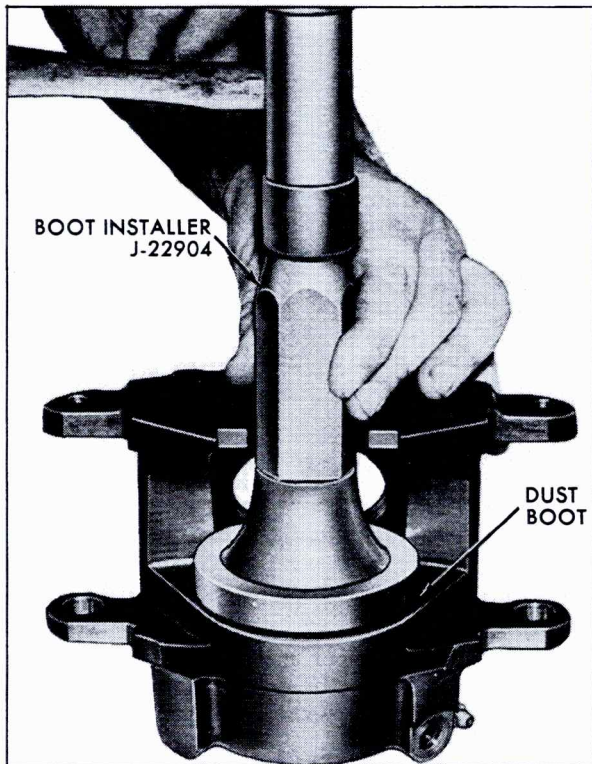


Fig. 5-15 Installing Dust Boot in Caliper

6. With dust boot evenly positioned in caliper counterbore, position Boot Installer, J-22904, on boot and tap with a plastic hammer to seat boot, Fig. 5-15.

7. Lubricate four new bushings with silicone lubricant and install bushings in caliper ears.

8. Lubricate new sleeves with silicone lubricant and install in inboard caliper ear. Position the sleeve so that end toward the shoe and lining assembly is flush with the machined surface of the ear.

9. Install caliper assembly as described in Note 10c.

12. Hub and Disc Assembly

The procedure for removing and installing the hub and disc assembly is described in Section 3, Note 16.

13. Servicing Discs

In manufacture, the hub and disc are machined as a unit and must be replaced as an assembly in the field.

In manufacture, disc tolerance for flatness and parallelism of the frictional surfaces is held to to .0007 inch and the finish of the frictional surfaces must be maintained to 15-80 inches. Field methods are not sufficiently accurate to achieve the above dimensions.

In normal use, a slight ridge of rust may form on the edge of the disc. This ridge may be removed with crocus cloth.

Scoring of the disc brake rotor, due to advanced wear of linings, does not always necessitate replacement of the rotor. Rotors with scoring of the surface, up to approximately .020 inch in depth, are not detrimental to brake operation and may be used with new linings.

When new linings are installed, the rotor should be lightly sanded.

In normal servicing of worn lining or on caliper removal, lateral runout of the rotor need not be checked, except when brake shudder is evident.

If brake shudder develops after long periods of use, it could be due to light surface deposits (such as lining oxides) on the braking surface of the rotor. These deposits, which appear as a dark blotch about the size of the lining, may be removed by sanding.

Brake shudder on low mileage cars can be due to excessive rotor lateral runout of out-of-parallelism. When checking lateral runout, on all cars except Eldorado, first tighten front wheel bearings to take up end front wheel bearings to take up end play. After checking runout, adjust wheel bearings to proper specification.

On cars other than Eldorado, if lateral runout is in excess of .0025", or parallelism is in excess of .0007", replace the rotor. There is no known service equipment presently available that can maintain parallelism and lateral runout specifications.

In addition, when performing any service on front disc brakes, inspect the rotor ventilation passages for obstructions, such as salt or mud build-up. Any build-up must be removed because it decreases brake cooling, which might lead to increased lining wear rate and brake shudder.

In view of the above specifications, machining of the disc in the field is not recommended. However, once a wear pattern has been established, disc brake cars are not as susceptible to problems occurring because of scored discs, as drum brake cars are due to scored drums. Therefore, discs should only be replaced on a selective basis to solve a brake malfunction.

NOTE: It is not necessary to replace both front rotors when only one is defective. Replace only defective rotors.

14. Metering Valve (All Except 693)

NOTE: The metering valve is a non-adjustable, non-serviceable valve. If defective it must be replaced.

a. Removal

1. Disconnect brake lines from metering valve, which is located on inside of left frame siderail, Fig. 5-9.

2. Remove screw securing metering valve to frame.

b. Installation

1. Loosely install metering valve to frame with attaching screw.

2. Start brake line tube nuts into metering valve.

NOTE: Metering valve inlet port, leading to distributor and switch assembly, is identified by the letter "M" and outlet ports, leading to the caliper assemblies are identified by the letter "F"

3. Tighten metering valve to frame screw to 10-15 ft. lbs.

4. Tighten brake line tube nuts to 20 ft. lbs. maximum torque.

5. Bleed brakes as described in Note 8.

15. Distributor and Switch Assembly (All Except 693)

NOTE: The distributor and switch assembly is non-adjustable and must be replaced as a unit, if defective.

a. Removal

1. Disconnect electrical lead from terminal on assembly.

2. Disconnect front and rear brake lines from master cylinder.

3. Disconnect forward brake line at assembly.

4. Remove screw securing distributor and switch assembly to frame.

5. Disconnect rear brake line and remove assembly with master cylinder lines and mounting bracket attached.

6. Disconnect master cylinder brake lines at distributor and switch assembly.

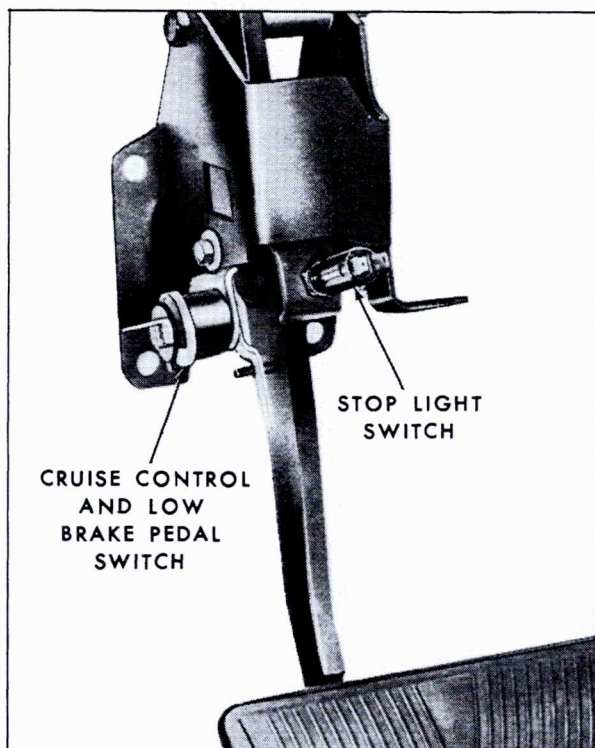


Fig. 5-16 Stoplight Switch Location

b. Installation

1. Position and connect two master cylinder lines at top of distributor and switch assembly, allowing just enough play to turn lines.

2. Position distributor and switch assembly in car and loosely install forward and rear brake lines at assembly and lines at master cylinder.

3. Install screw securing assembly to frame.

4. Tighten all six brake line fittings, four at assembly and two at master cylinder to 20 foot-pounds maximum.

5. Connect electrical lead at assembly.

6. Bleed brakes as described in Note 8.

16. Stoplight Switch Removal, Installation and Adjustment

a. Removal

1. Disconnect two lead wires from stoplight switch.

2. Remove front locking nut from switch, Fig. 5-16.

3. Remove stoplight switch.

b. Installation

1. Position switch on pedal bracket flange.

2. Install front locking nut, Fig. 5-16.

3. Connect lead wires to switch.

4. Check operation of stoplight.

c. Adjustment

Adjust switch action so that stoplight is "on" when brake pedal is depressed 1/2 inch. Loosen front and rear nuts that hold stoplight switch and move switch up or down until this action is obtained. Tighten switch locknuts securely to prevent loss of adjustment. Body of switch must not interfere with brake pedal arm when arm is in fully retracted position.

17. Servicing Hydraulic Brake Hoses and Piping—(All Except 693)

Hydraulic pressure is transferred to the wheel cylinders through steel brake piping, and flexible hoses, Fig. 5-17.

The steel brake lines and flexible hoses should be inspected every spring and fall for damage that may occur from various road hazards.

While the flexible hoses and steel piping require no periodic servicing, it may be necessary to replace damaged hoses or piping in the following manner:

a. Removal—Hydraulic Brake Hose (Front Wheels)

1. Disconnect steel brake line from hose. Cap fitting to prevent dirt from entering brake line.

2. Remove U-shaped retainer from hose fitting and withdraw hose from frame support bracket.

3. Turn hose fitting out of caliper inlet and remove copper gasket. Discard gasket. If hose is to be reinstalled, cover end fittings to prevent dirt from entering hose.

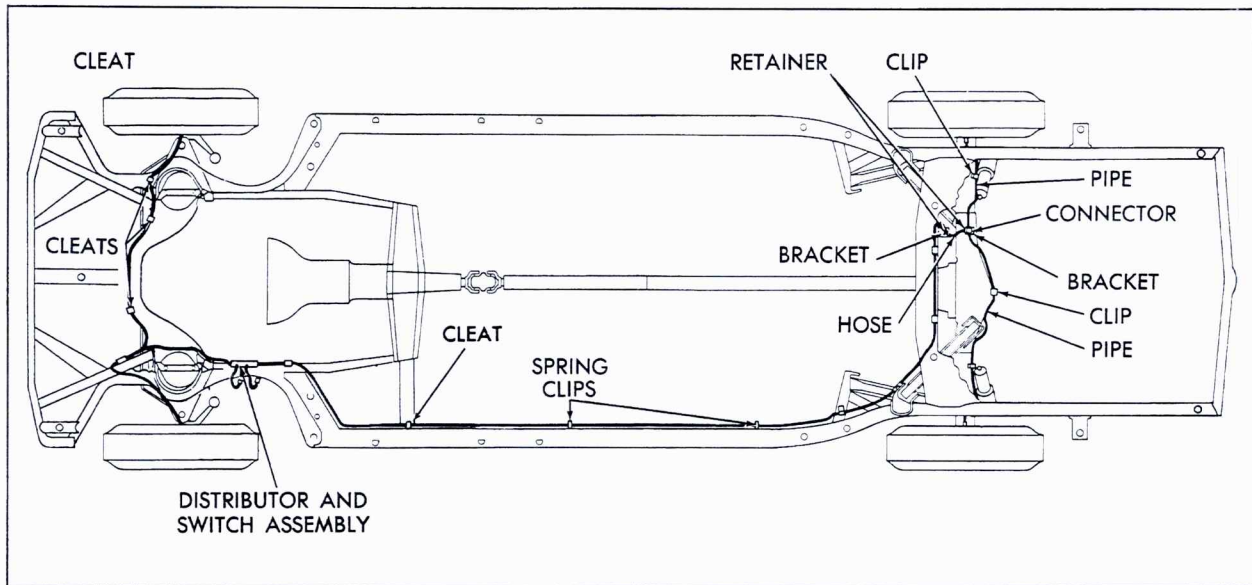


Fig. 5-17 Hydraulic Brake Lines

b. Installation—Hydraulic Brake Hoses (Front wheels)

1. Install new copper gasket on caliper end of hose (male end). Tighten hose in caliper inlet to 30 foot-pounds maximum torque.

CAUTION: Never tighten hose in caliper inlet with hose attached at frame ends as this will twist the hose.

2. With suspension in normal position (front wheels straight ahead) pass female end of hose through frame support bracket, allowing hose to seek its own position. Insert hex of hose fitting into the 12-point hole in support bracket in position that will result in least twist in hose.

NOTE: Do not twist hose any more than necessary during this operation as its natural curvature is essential to maintain proper hose-to-suspension clearance through full movement of suspension and steering parts.

3. Install U-shaped retainer to secure hose in frame support bracket.
4. Inspect by turning steering from stop-to-stop while observing hose position. Be sure that hose does not touch other parts at any time during steering travel. If contact does occur, remove hose retainer and rotate female hose end in support bracket one or two points in appropriate direction, replace retainer, and reinspect.
5. Place steel tube connector nut in hose fitting and tighten to 20 foot-pounds maximum torque.
6. Bleed all brakes as outlined in Note 8.

c. Removal—Hydraulic Brake Hose (Rear Wheels)

1. Disconnect steel brake pipe from hose. Cap pipe.

2. Remove retainer securing forward end of brake hose to bracket.

3. Disconnect hose from junction block on rear axle.

d. Installation—Hydraulic Brake Hose (Rear Wheels)

1. Install hose in junction block on rear axle, tightening to 20 foot-pounds maximum torque.
2. Pass female end of hose through mounting bracket, allowing hose to seek its own position. Insert hex of hose fitting into the 12-point hole in mounting bracket in position that will result in least twist in hose.
3. Install retainer securing forward end of hose to mounting bracket.
4. Tighten fitting to 20 foot-pounds maximum torque.
5. Bleed brakes as described in Note 8.

e. Removal—Hydraulic Brake Piping (Rear Wheels)

1. Disconnect steel brake piping at rear wheel cylinder fitting. Cap fitting to prevent dirt from entering wheel cylinder.
2. Disconnect brake piping at T-connector on axle housing.
3. Unbend from welded retainer(s) on axle housing, and remove piping.

f. Installation—Hydraulic Brake Piping (Rear Wheels)

1. Install steel piping on welded retainers.
2. Connect piping at T-connectors and tighten to 15 foot-pounds maximum torque.
3. Connect piping at wheel cylinder fitting, tightening to 20 foot-pounds maximum torque.
4. Bend welded retainer(s) over piping enough

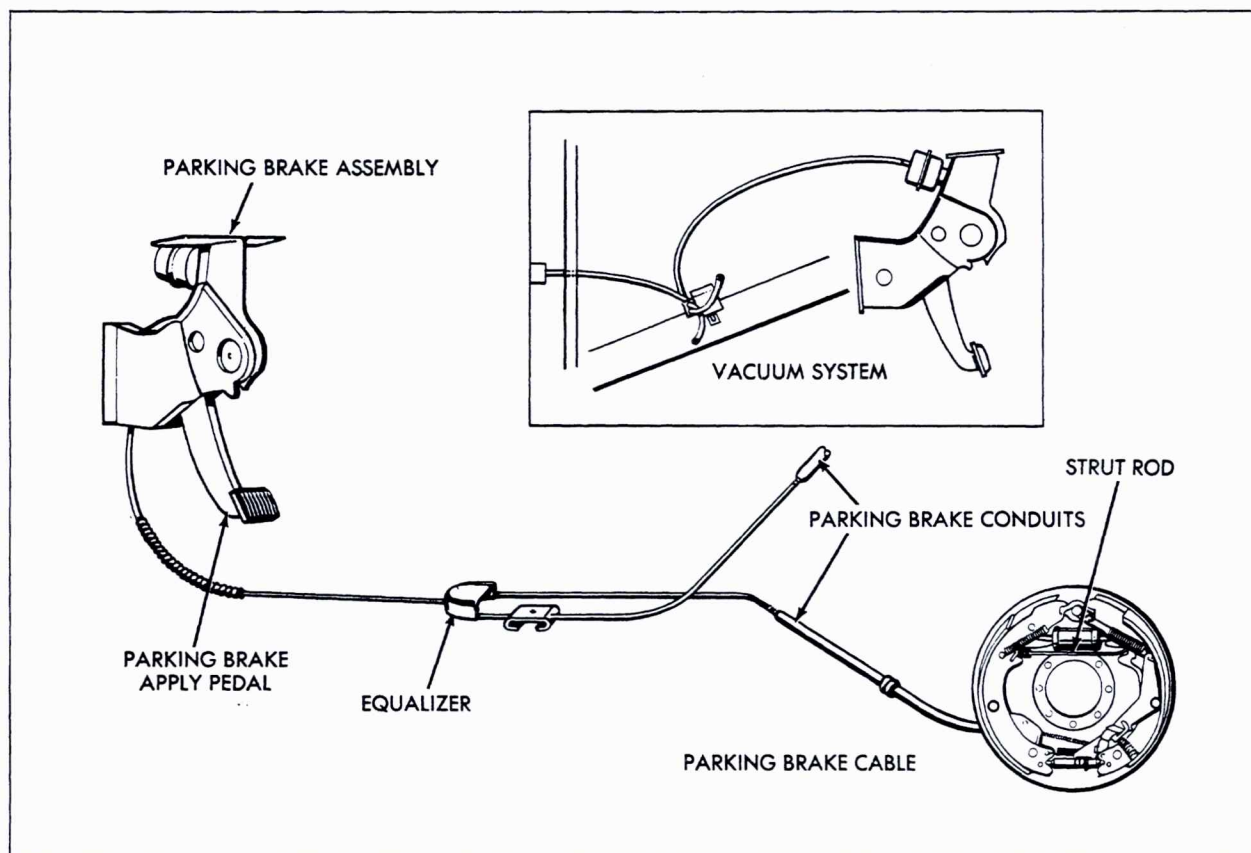


Fig. 5-18 Parking Brake Linkage

to secure, being careful not to damage brake piping.

5. Bleed all brakes as outlined in Note 8.

18. Parking Brake Preliminary Checks

It is not always necessary to replace the parking brake assembly or vacuum diaphragm assembly in cases of an inoperative parking brake automatic release. The following checks should be performed as part of your diagnosis to determine the cause and correction of parking brake trouble and to eliminate unnecessary replacement of parking brake components.

1. Check vacuum cylinder piston travel by running engine and moving transmission selector lever from Drive to Neutral. The manual release lever should move up and down as vacuum is applied and released. If no movement is observed, check vacuum system per steps 2 and 3. If movement is slow, (more than one or two seconds to complete the full stroke) diaphragm is leaking or hoses are partially pinched or kinked. Vacuum diaphragm may be replaced as outlined in Note 20.

2. Check for damaged or kinked vacuum hoses and for loose hose connections at parking brake vacuum cylinder, vacuum release valve at neutral switch, and at engine manifold connection.

3. Check adjustment of neutral switch and operation of vacuum release valve. Correct as necessary and recheck parking brake operation.

4. Check brake release with vacuum applied. If

vacuum cylinder piston completes full stroke but does not release brake, a malfunction of the pedal assembly is indicated. Replace complete parking brake assembly as described in Note 19.

5. Check operation of parking brake with engine off. Parking brake should remain engaged regardless of transmission selector lever position. If not, replace parking brake assembly.

19. Parking Brake Assembly (All Except 693)

a. Removal

1. Remove steering column lower cover as explained in Section 12, Note 45a.

2. Place parking brake pedal in release position. Set transmission shift lever in Park position.

3. Working underneath car, remove equalizer nut and washer and separate cable stud from equalizer.

4. Disconnect parking brake vacuum hose at cylinder.

5. Position carpet and left cowl kick-pad out of the way.

6. Remove two parking brake assembly-to-instrument panel mounting bolts.

7. Remove two parking brake assembly-to-cowl mounting nuts and move assembly away from cowl.

8. Position brake pedal lever so that clevis on parking brake assembly is exposed, and remove brake cable end from clevis.

b. Installation

1. Position parking brake pedal so that clevis is exposed, and attach parking brake cable to clevis on parking brake assembly.
2. Place parking brake assembly on studs on cowl, attaching with two mounting nuts.
3. Install two parking brake assembly-to-instrument panel mounting bolts.
4. Connect hose to parking brake vacuum cylinder.
5. Replace cowl kick-pad and carpet.
6. Insert cable stud through equalizer, making sure the rear cables are properly routed through equalizer and secured at C-shaped clamp, Fig. 5-23.
7. Install washer and equalizer nut.
8. Adjust parking brake as described in Note 2.
9. Check operation of automatic release.
10. Install steering column lower cover, as explained in Section 12, Note 45b.

20. Parking Brake Vacuum Diaphragm**a. Removal**

1. Remove parking brake assembly as described in Note 19a.
2. Drill out one rivet that retains cylinder to parking brake assembly.
3. Detach link that connects cylinder to manual release lever and remove cylinder.

b. Installation

1. Position cylinder on parking brake assembly and secure with one rivet or bolt and nut.
2. Secure link to manual release lever.
3. Install parking brake assembly as described in Note 19b.
4. Test lock and automatic release operations with engine running in Neutral and Drive ranges.

NOTE: Parking brake should release in any drive range with engine running, and should remain engaged in Neutral and Park with engine running.

21. Parking Brake Cables**a. Removal—Front Cable (All)**

1. Release parking brake.
2. Remove hook supporting front cable to underbody.
3. Disconnect cable stud at equalizer by removing equalizer nut and washer, Fig. 5-18, and separating cable stud from equalizer.
4. Remove U-shaped retainer at frame.
5. Depress pedal, and clamp clamping type pliers on cable at toe pan fitting.
6. Release pedal and remove cable end from parking brake assembly clevis.
7. Remove clamping type pliers.
8. Compress prongs on cable fitting at toe pan and push cable assembly out from inside car.

9. Pull cable through hole in frame and remove from car.

b. Installation—Front Cable (All)

1. Insert cable through hole in frame.
2. Install U-shaped retainer at frame.
3. Install cable through cowl from under hood.

NOTE: Expanders on cable will "click" into position when cable is inserted through cowl.

4. Pull cable through from inside of car as far as possible, and clamp cable with clamping type pliers at toe pan fitting.
5. Install cable end to parking brake assembly clevis.
6. Remove pliers from cable.
7. Connect cable stud at equalizer by installing washer and nut.
8. Install hook supporting cable to underbody.
9. Check operation of parking brake system and adjust if necessary as outlined in Note 2.

c. Removal—Rear Cables (All Except 693)

1. Release parking brake.
2. Raise rear of car and place on jack stands.
3. Remove rear wheel and drum on same side of car as parking brake cable being replaced.
4. Remove equalizer nut and washer, and separate equalizer from front cable stud.
5. Remove end of cable being replaced from C-clamp.
6. If right parking brake cable is being replaced, pry open ears of equalizer and remove cable from equalizer.
7. Remove horseshoe clip securing cable to front bracket and remove cable from bracket by pulling rearward.
8. If right cable is being replaced, remove three snap-in clips securing cable to floor pan.
9. Remove two screws securing parking brake cable clamp to brake backing plate.
10. Remove pawl spring and pawl lever from actuating lever.
11. Remove cable end from operating lever, and remove cable from backing plate.

d. Installation—Rear Cables (All Except 693)

1. Route cable end through rear of backing plate and install on operating lever.
2. Install pawl lever and pawl spring.
3. Position parking brake cable clamp against backing plate, securing with two screws. Tighten screws to 11 foot-pounds maximum torque.

CAUTION: Check operation of cable and brake shoes by pulling on front end of cable.

4. Route cable over top of rear suspension lower control arms.
5. If right cable is being installed, position cable against floor pan and secure with three snap-in clips.
6. Insert cable through hole in frame bracket and secure with horseshoe clip.
7. If left cable is being installed, install cable

in equalizer slot and bend equalizer ears over cable. Brush small amount of lubricant in equalizer slot.

8. Install cable end in C-shaped clamp.
9. Insert front cable stud through equalizer hole and install equalizer washer and nut.
10. Install rear drum and wheel.
11. Adjust parking brake as described in Note 2.

22. Power Brake Unit

a. Removal

1. Disconnect hydraulic brake lines from master cylinder, Fig. 5-19. Cap line fittings to prevent dirt from entering brake lines.

2. Disconnect vacuum hose from vacuum check valve on power head.

3. Remove steering column lower cover as described in Section 12, Note

4. Remove cotter pin and washer that attach power unit push rod to brake pedal arm.

5. Remove any three of four nuts securing power unit to cowl and loosen fourth nut.

6. Working in engine compartment, free power unit from cowl.

7. Disconnect brake unit push rod from brake pedal arm. Remove spring spacer from brake pedal arm.

8. Remove remaining nut retaining power unit to cowl, and remove power unit from engine compartment.

b. Installation

1. Position power unit to cowl.
2. Working inside passenger compartment, loosely install four nuts retaining power unit to cowl.
3. Install spring spacer, push rod and washer on brake pedal arm and secure with cotter pin.
4. Tighten four nuts that hold the power unit to 10 to 16 foot-pounds.

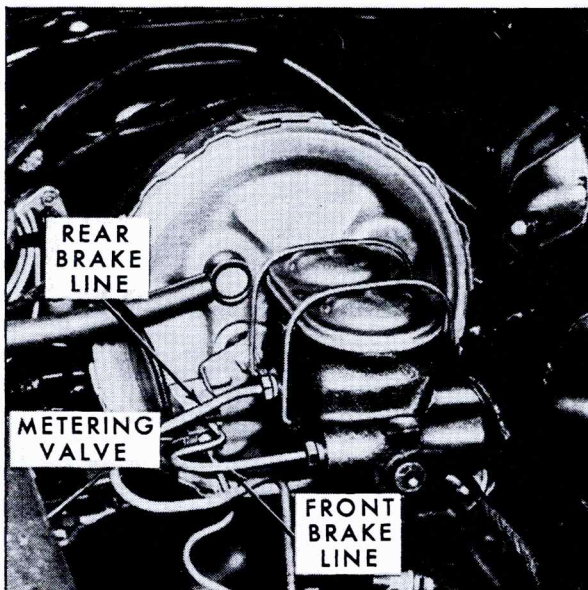


Fig. 5-19 Power Brake Unit

5. Install steering column lower cover as described in Section 12, Note

6. Connect vacuum hose to check valve on power unit.

7. Secure hydraulic brake lines to master cylinder to 25 foot-pounds maximum. Front wheel brake line connects to forward master cylinder outlet.

8. Bleed brakes as described in Note 8.

23. Delco Moraine Single Diaphragm Power Head Disassembly, Cleaning, Inspection and Assembly

a. Disassembly

1. Scribe a line on top center of front and rear shells of power head in line with master cylinder reservoir cover.

2. Remove master cylinder reservoir cover and seal, and drain fluid from reservoirs. Push in on push rod several times to force fluid from master cylinder bore and to vent vacuum in power head.

3. Place assembly in bench vise with rear shell up, tighten vise jaws securely on master cylinder, Fig. 5-20, and remove dust guard retainer, dust guard and silencer from rear shell.

CAUTION: Avoid excessive tightening as master cylinder casting may crack.

CAUTION: Use care when removing separator tool as power piston return spring may cause rear shell to fly off when pressure is released.

4. Install Power Unit Shell Separator, J-9504, over mounting studs on rear shell, Fig. 5-20. Applying downward pressure, rotate rear shell counterclockwise, disengaging it from front shell.

5. Remove rear shell, power piston assembly and piston return spring, Fig. 5-21, from front shell.

6. Separate power piston assembly from rear shell and remove power piston bearing seal from center of rear shell.

7. Remove air filter and limiter washer from power piston insert tube surrounding push rod and remove air filter ring from O.D. of tube.

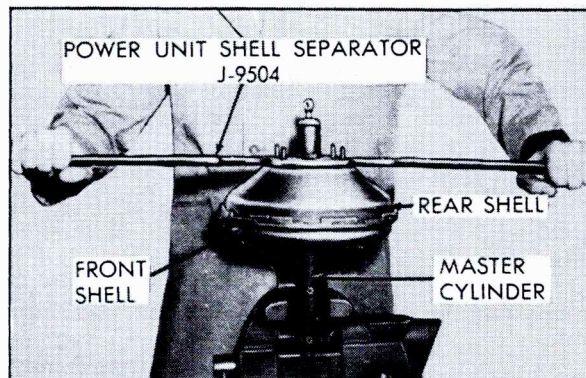


Fig. 5-20 Removing Rear Shell - Single Diaphragm

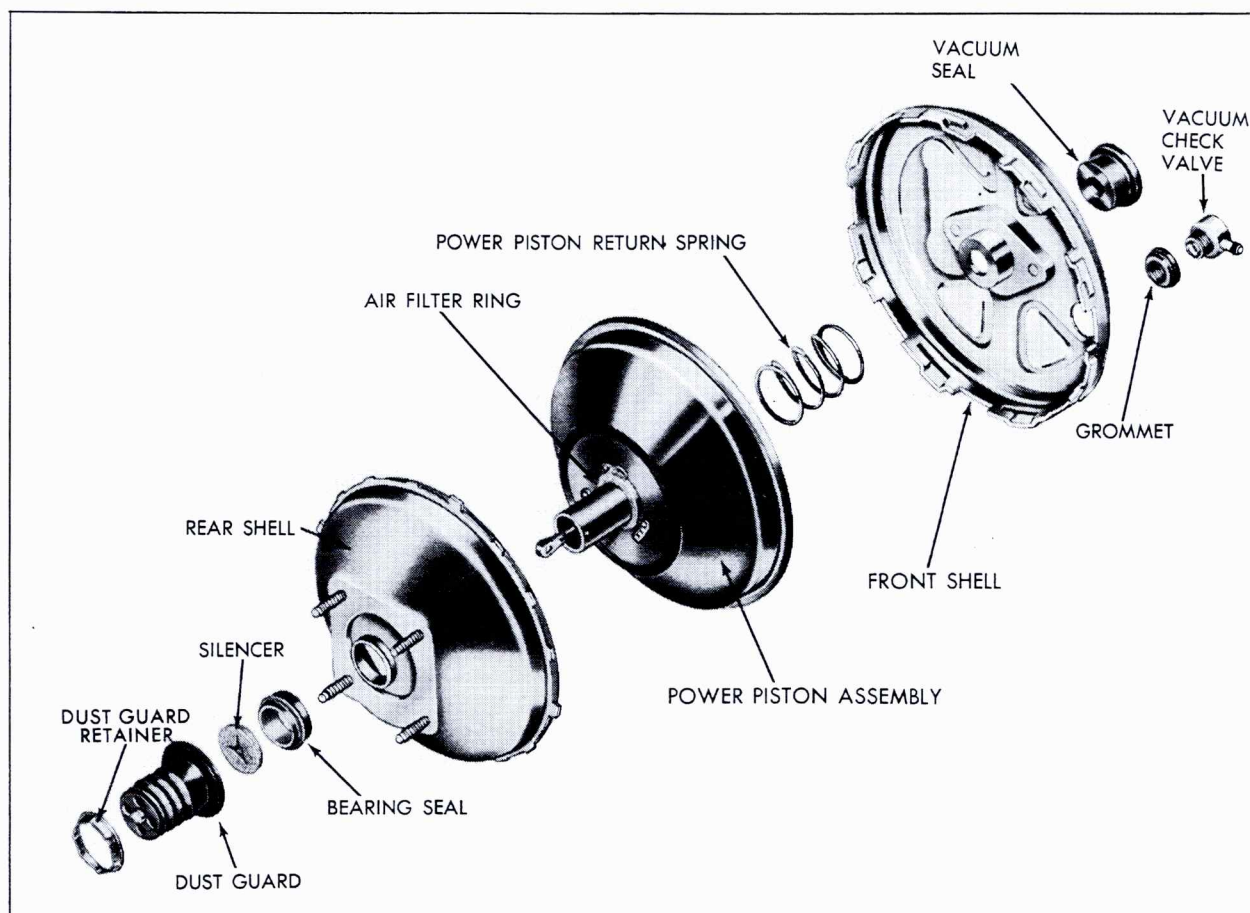


Fig. 5-21 Single Diaphragm Power Head Disassembled

8. Remove vacuum check valve and grommet from front shell.

9. Remove two self-locking nuts that hold master cylinder to front shell and remove front shell from master cylinder.

10. Remove vacuum seal from center of front shell.

11. Remove master cylinder from vise, and clamp control valve and rod assembly in vise with power piston insert tube resting on top of vise jaws, Fig. 5-22.

12. Pry one end of lock ring from large divided locking lug on power piston insert, using a screwdriver, and remove lock ring.

13. Lift reaction retainer off power piston insert and then remove master cylinder push rod assembly from reaction retainer.

14. Remove O-ring from groove on rear end of master cylinder push rod.

15. Remove reaction plate, three reaction levers, reaction spring, air valve spring, reaction bumper and air valve spring retainer from power piston insert, Fig. 5-23.

16. Using Snap Ring Pliers #22, J-4880, remove snap ring from groove on end of air valve push rod.

17. Grasp power piston support plate firmly, and lifting upward, pull power piston insert off of control valve and rod assembly.

18. Remove air valve assembly from vise.

NOTE: The control valve and push rod are serviced as an assembly.

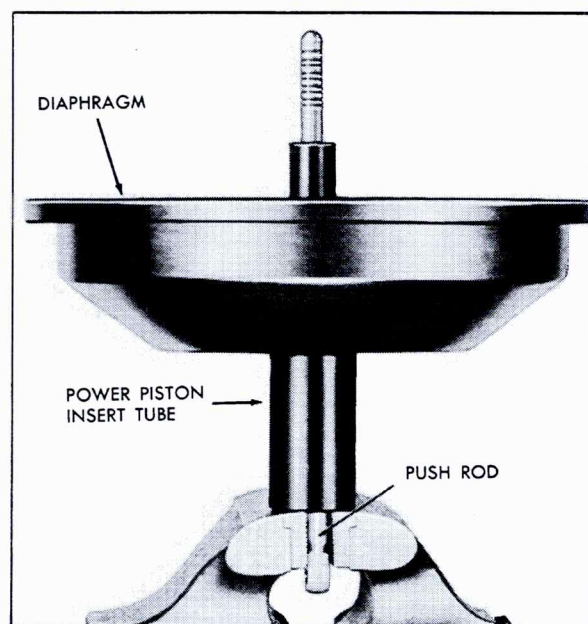


Fig. 5-22 Mounting Power Piston in Vise

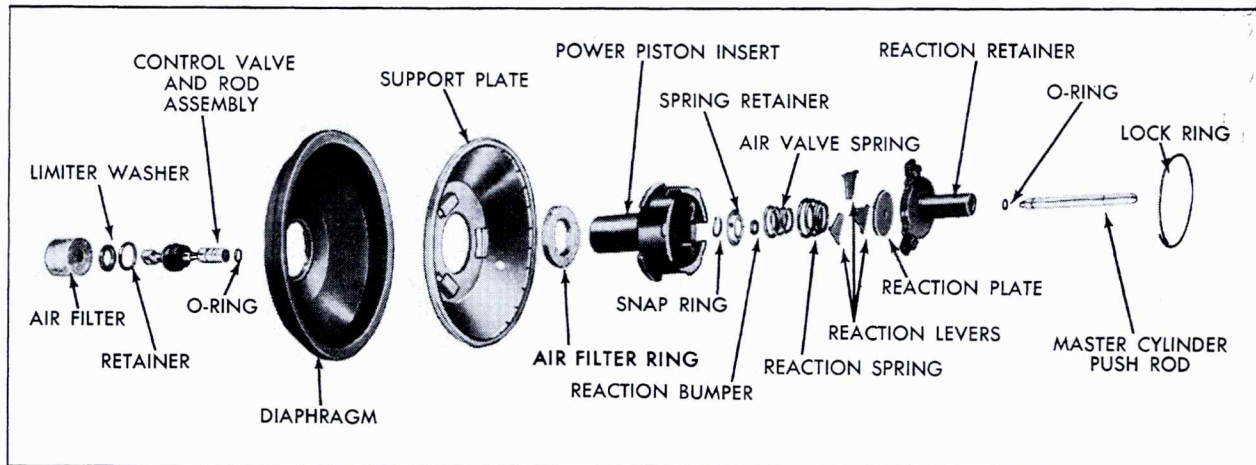


Fig. 5-23 Single Diaphragm Power Piston Disassembled

19. Place square shank of Power Piston Insert Wrench J-21524, in vise and position power piston assembly on wrench so that the three notches in power piston housing fit over ears of tool, Fig. 5-24.

20. Rotate support plate counterclockwise until support plate separates from power piston insert, Fig. 5-24.

21. Remove diaphragm from support plate.

b. Cleaning and Inspection

1. Thoroughly wash all parts in clean alcohol.

CAUTION: Use of gasoline, kerosene, anti-freeze or any other cleaner with even a trace of mineral oil will damage rubber parts.

2. Use air hose to blow out all passages, orifices, and valve holes. Air dry and place cleaned parts on clean paper or lint-free cloth.

3. If any rust is found inside front or rear shell, polish clean with crocus cloth or fine emery paper, washing clean afterwards.

4. Inspect front and rear shells for scratches, scores, pits, dents or other damage affecting rolling or sealing of diaphragm or other seals. Small imperfections may be smoothed out with fine crocus cloth.

5. Inspect all original parts, not being replaced

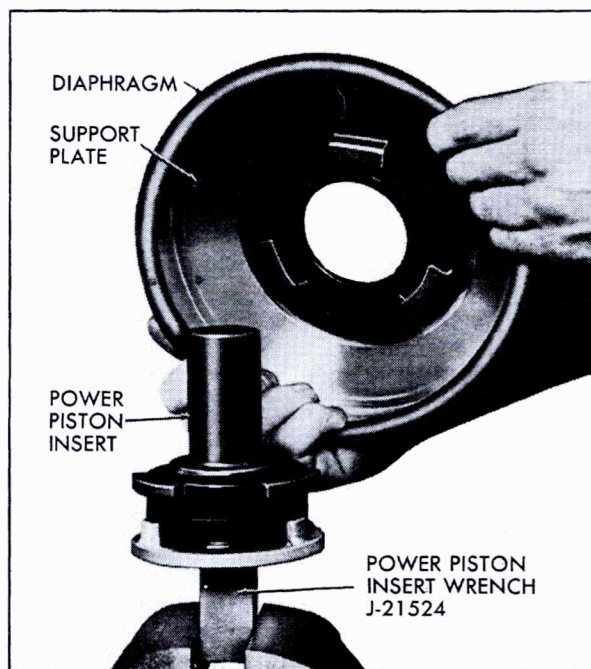


Fig. 5-24 Removing Power Piston Insert

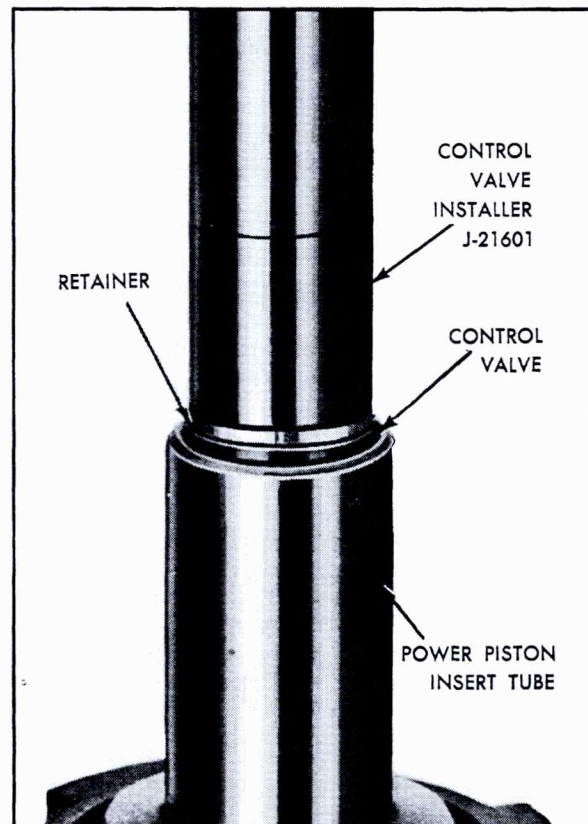


Fig. 5-25 Installing Control Valve Assembly

by repair kit, for damage, distortion or excessive wear and chips, and replace as necessary.

6. Use all parts furnished in power head repair kit.

c. Assembly

Be sure all parts are clean before assembling unit. Do not let grease or mineral oil come in contact with any rubber parts.

Lubricate rubber parts of power piston group with special lubricant included in service repair kit.

1. Wipe a thin film of special lubricant on large O.D. of control valve and air valve O-ring.

2. Position control valve and rod assembly in neck of power piston insert tube and position spring, cup and retainer on top of control valve. Using Control Valve Assembly Installer, J-21601, seat assembly in tube, Fig. 5-25.

3. Install push rod limiter washer and air filter into neck of tube.

4. Using Snap Ring Pliers #22, J-4880, install snap ring in groove on end of control valve and rod assembly.

CAUTION: Avoid over-expanding snap ring.

5. Assemble power piston diaphragm to support plate. Raised flange of diaphragm is pressed through center hole in support plate.

6. Place square shank of Power Piston Insert Wrench, J-21524, in vise and position power piston insert on wrench so that grooves in power piston fit over ears of tool.

7. Wipe a thin film of special lubricant on all surfaces of power piston diaphragm that contact power piston insert.

8. Position support plate on power piston insert and rotate support plate clockwise until lugs of power piston insert lock against stops on support plate.

NOTE: Visually inspect assembly to make sure that lugs are against stops.

9. Install air filter ring on O.D. of power piston insert tube.

10. Clamp control valve and rod assembly in vise with power piston insert tube resting on vise jaws, Fig. 5-22.

11. Seat air valve spring retainer on snap ring with large end down.

12. Install reaction bumper on end of control valve and rod assembly.

13. Place large diameter end of conical air valve spring on spring retainer.

14. Place reaction spring over air valve spring.

15. Position ears of reaction levers in molded locations in power piston insert and rest small ends of levers on air valve spring.

16. Center reaction plate on top of reaction levers.

17. Place new O-ring on groove on rear of master cylinder push rod and lubricate O-ring with special lubricant.

18. Push master cylinder push rod through reaction retainer.

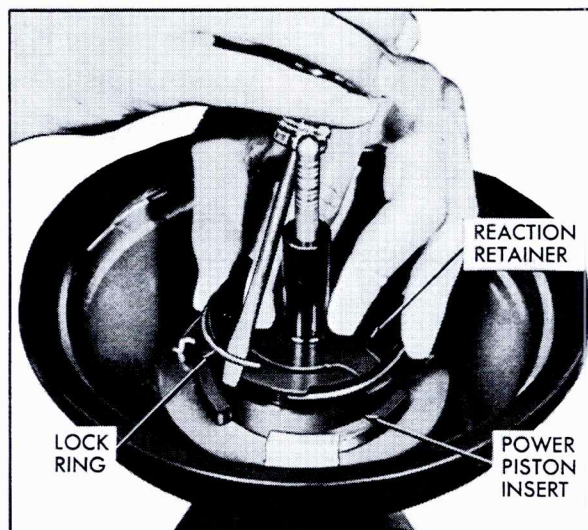


Fig. 5-26 Installing Power Piston Lock Ring

19. Place small end of master cylinder push rod in reaction plate center hole and align retainer ears with grooves in power piston insert.

20. Place lock ring over reaction retainer. Press down and hold reaction retainer while installing lock ring by starting one end of ring under large divided locking ear on power piston insert. Complete installation by working ring over and under appropriate locking ears, Fig. 5-26.

21. Remove power piston assembly from vise and install master cylinder in vise, power head end up.

CAUTION: Avoid excessive tightening as master cylinder casting may crack.

NOTE: The front vacuum seal is being left out at this point to facilitate subsequent push rod length check.

22. Position front shell studs through master cylinder mounting holes and install nuts finger tight.

23. Install vacuum check valve grommet in front shell with large diameter outside.

24. Install vacuum check valve.

25. Install power piston return spring in front shell.

26. Install power piston bearing seal in center hole in rear shell with large flange outside. Lubricate grooves in I.D. of bearing with special lubricant.

NOTE: Flange of seal should contact shell.

27. Insert silencer in dust guard.

28. Install dust guard and retainer on rear shell.

29. Insert power piston, air valve push rod first, into rear shell. Tube of power piston fits through power piston bearing seal, and push rod fits through silencer and dust guard.

30. Position rear shell and power piston assembly onto front shell. Align scribe marks on

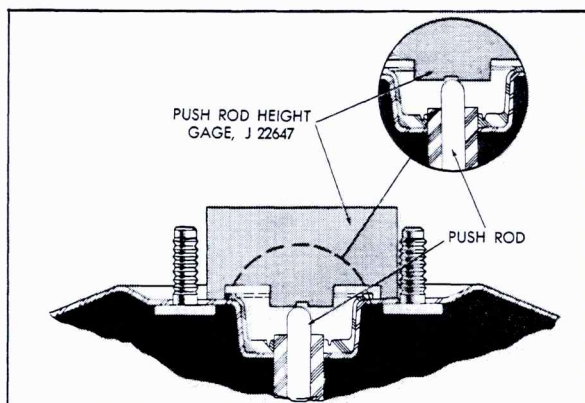


Fig. 5-27 Checking Pushrod Height

shells so that scribe marks will line up when shells are rotated into locked position.

31. Pressing downward on rear shell, start locking tangs into grooves by rotating rear shell clockwise. Install Power Unit Shell Separator, J-9504, over mounting studs on rear shell and rotate shell clockwise against stops.

NOTE: Master cylinder push rod is designed to provide the correct relationship between vacuum piston and master cylinder piston. This height is important as it provides for the compensating port being kept open while unit is in released position. The push rod is at the correct height when assembled, and, under

normal service, will not require adjustment. When unit has been disassembled and reassembled, however, height should be checked as follows:

32. Remove master cylinder from power head assembly.

33. Push master cylinder push rod in place and place Push Rod Height Gage, J-22647, in a position that will allow the gage to be moved to the left or right without contacting the studs.

34. The center section of the gage has a go and a no-go level. The push rod end should touch the no-go level of the gage, but should not touch the go level. Move gage from side-to-side to check push rod height, Fig. 5-27.

35. If push rod height does not check correctly, the non-adjustable push rod will have to be replaced with a service push rod that has a self-locking adjustment screw. Proceed as follows:

a. Pull master cylinder push rod assembly straight out from reaction retainer.

b. Remove O-ring from push rod and inspect for damage. If it appears usable, place on service push rod, lubricate with special lubricant and push service push rod straight into reaction retainer until it bottoms.

c. Repeat steps 33 and 34.

d. If adjustment is needed, turn adjusting screw in or out as required.

36. Wipe a thin film of lubricant on new vacuum seal.

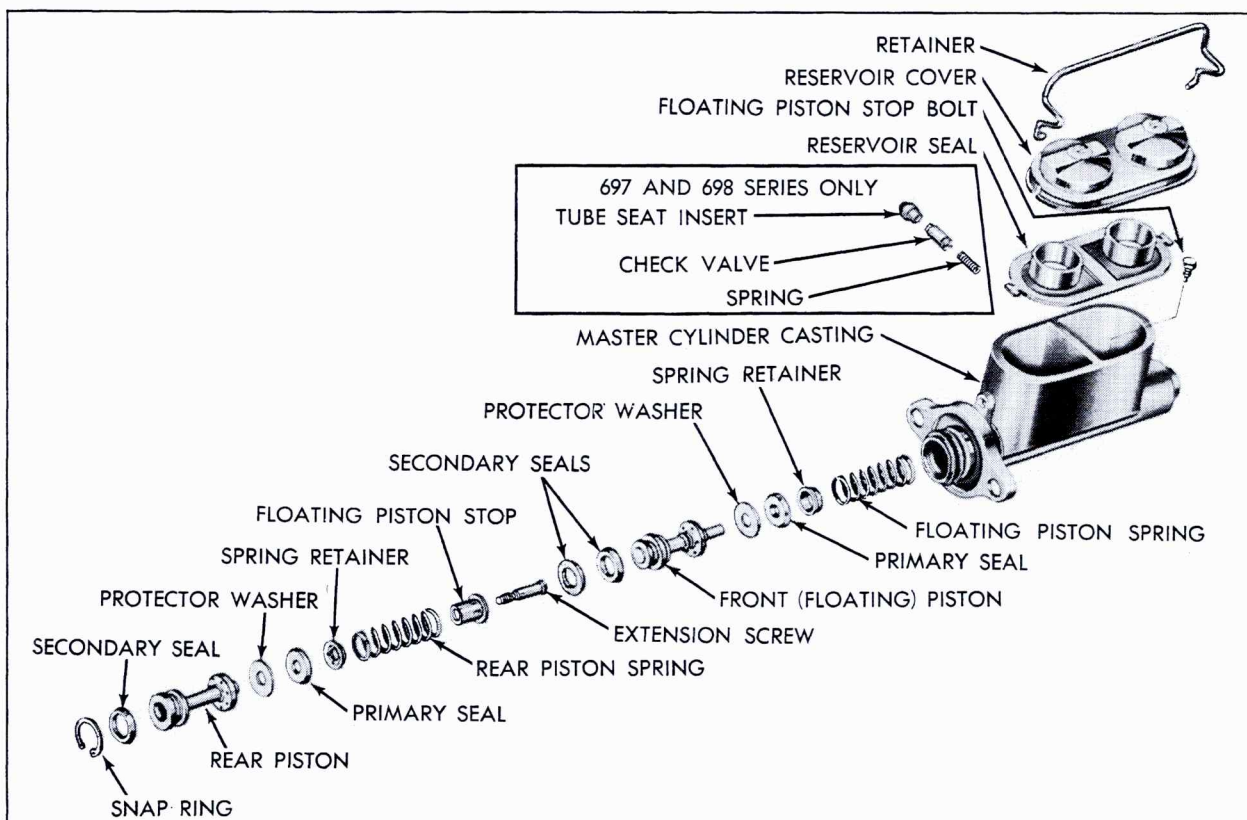


Fig. 5-28 Master Cylinder Disassembled

37. Install vacuum seal in outside center of front shell.

38. Install vacuum power head on master cylinder with check valve toward reservoir cover, and torque nuts to 10-16 foot-pounds maximum torque.

24. Delco Moraine Master Cylinder Disassembly, Cleaning, Inspection and Assembly, (Fig. 5-28)

a. Disassembly

NOTE: If trouble has been traced to hydraulic system, master cylinder may be removed from power head without removing power head from car. Area surrounding master cylinder mounting surface must be kept clean.

1. Disconnect and cap front and rear brake lines if not done previously.

2. Remove two self-locking nuts that hold master cylinder to power head and remove master cylinder.

3. Pry bale type retainers off of reservoir cover, and remove reservoir cover and seal. Drain brake fluid from reservoirs.

4. Remove seal from reservoir cover.

5. Remove floating piston stop bolt from front fluid reservoir.

6. Remove lock ring from open end of master cylinder and remove rear piston assembly, Fig. 5-28.

7. Firmly rap master cylinder on a block of wood until floating piston drops in bore and remove front (floating) piston assembly, retainer and spring.

CAUTION: Check progress of floating piston dropping in bore to avoid striking piston on wood. If floating piston sticks in bore, blow dry compressed air through front brake outlet hole.

8. Place master cylinder in vise with outlet holes up being careful not to damage reservoir seal surface of casting.

9. Remove the primary seal, primary seal protector and secondary seals from the front (floating) piston.

10. Remove piston extension screw from center of floating piston stop and remove floating piston stop and spring from rear piston.

NOTE: If necessary, grasp the unfinished piston body immediately under flange containing compensating holes with a pair of pliers to remove piston extension screw.

11. Remove spring retainer, primary seal, primary seal protector and secondary seal from the rear piston.

12. 1969 Series 697 and 698 cars are equipped with a check valve in the rear fluid outlet only. To remove the valve or to replace the tube seat inserts on all other cars, proceed with Step 13.

13. Run a #6-32 tap into hole of tube seat insert.

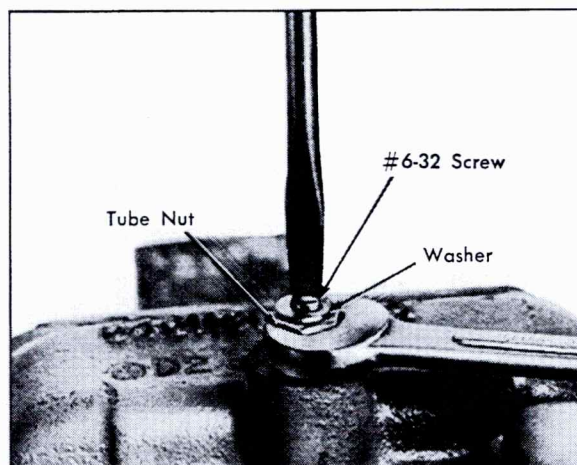


Fig. 5-29 Removing Tube Seat Inserts

14. Install a spare brake line tube nut in outlet hole, place a flat washer on a 1 inch #6-32 screw and thread screw into hole in tube seat insert, Fig. 5-29.

15. To pull insert, hold screw from turning and turn tube nut out of outlet hole, Fig. 5-29. Remove both inserts in this manner and discard.

16. From cavity beneath tube insert, remove rubber check valve and check valve spring, Fig. 5-28.

17. Remove the primary seal, primary seal protector and secondary seals from the front (floating) piston.

18. Remove piston extension screw from center of floating piston stop and remove floating piston stop and spring from rear piston.

NOTE: If necessary, grasp the unfinished piston body immediately under flange containing holes with a pair of pliers to remove piston extension screw.

19. Remove spring retainer, primary seal, primary seal protector and secondary seal from the rear piston.

b. Cleaning and Inspection

1. Inspect master cylinder bore for scoring, pitting or etching. Any of these will require replacement of master cylinder casting.

2. Examine fluid reservoir for foreign matter, and check all passages for restrictions. If there is any suspicion of contamination or evidence of corrosion, completely flush hydraulic system, using clean brake fluid.

A grease-like silicone substance may be found inside the brake master cylinder when it is being overhauled. This substance is used by the manufacturer as a lubricant to provide smooth brake actuation. It is a normal condition and need not be cleaned out of the master cylinder before reassembly.

3. Inspect floating piston for severe scoring, pitting, or distortion. Any of these will require replacement of master cylinder assembly.

NOTE: Floating piston may show a wear pattern; however, do not replace assembly unless wear is severe.

4. Thoroughly wash all parts in clean alcohol, including new parts to be used in assembly of master cylinder but do not wash silicone out of master cylinder.

CAUTION: Use of gasoline, kerosene, anti-freeze, or any other cleaner with even a trace of mineral oil will damage rubber parts.

5. Use air hose to blow out all passages, orifices, and valve holes. Air dry and place cleaned parts on clean paper or lint-free cloth.

6. When overhauling a master cylinder, use all parts furnished in master cylinder repair kit.

c. Assembly

Be sure all parts are clean before assembling master cylinder. Do not let grease or mineral oil come in contact with any rubber parts.

1. Lubricate rubber parts with clean brake fluid.

2. Install new secondary seal in center groove of floating piston. Lip of seal should face compensating holes in opposite end of piston.

3. Install new secondary seal in groove at end of floating piston, back-to-back with secondary seal in center groove, Fig. 5-28, so that lip faces toward that end.

4. Install primary seal protector and primary seal over end of floating piston opposite secondary seals. Seal protector seats against flange of piston that contains compensating holes, and flat side of seal seats against protector.

5. Install secondary seal in groove on push rod end of rear piston. Lip of seal should face toward compensating holes in opposite end of piston.

6. Install primary seal protector and primary seal on opposite end of rear piston. Seal protector seats against flange of piston that contains compensating holes, and flat side of seal seats against protector.

7. Position spring retainer on one end of rear piston spring and floating piston stop on other end.

8. Position spring assembly on rear piston with spring retainer seated inside lips of primary seal.

9. Insert piston extension screw in center of floating piston stop.

10. Compress primary piston spring and start piston extension screw in hole in end of piston, release spring and turn down screw. Torque to 7-8 foot-pounds to bottom shoulder on screw against retainer.

11. Position retainer in floating piston spring and position spring assembly on floating piston with retainer seated inside lip of primary seal.

12. Coat master cylinder bore, primary seal and secondary seals on floating piston with clean brake fluid.

13. Position master cylinder casting in vise so that open end of bore is down slightly and install

floating piston assembly in bore, spring end first, until assembly bottoms in bore.

14. Reposition master cylinder in vise so that open end of bore is up.

15. Coat primary and secondary seals on rear piston assembly with clean brake fluid and insert assembly into master cylinder bore, spring end first.

16. Pressing downward on rear piston, install lock ring in groove in master cylinder piston.

17. Install floating piston stop bolt in front fluid reservoir, tightening to 3 foot-pounds maximum torque.

18. Install new reservoir seal on reservoir cover, place cover on master cylinder, retaining with bale-type retainers.

19. Install master cylinder on power head, torquing nuts to 20 foot-pounds maximum torque.

20. Install front and rear brake lines, if power head is on car, tightening lines to 15 foot-pounds and bleed brakes as described in Note 8.

25. Testing Brake System

a. Vacuum Power Section

1. Attach one end of a spare windshield washer pump inlet hose to the port nearest the shut-off valve of tool J-23108, Fig. 5-30.

2. Disconnect power brake hose from vacuum fitting at base of carburetor and attach the other end of the windshield washer pump inlet hose to this fitting. A small amount of silicone lubricant will facilitate installation, Fig. 5-30.

3. Connect the power brake hose to other port of the tester and secure with hose clamp, Fig. 5-30.

Test Procedure

1. Run engine at idle for approximately 1/2 minute.

2. Turn off shut-off valve on tee.

3. Note vacuum gage reading.

4. Apply brakes with estimated 20-30 pounds

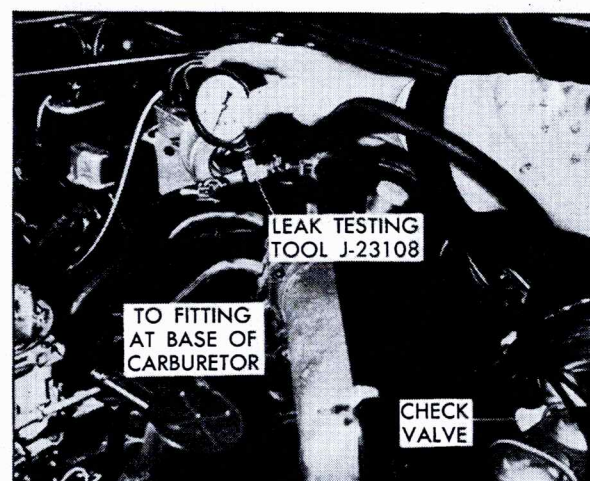


Fig. 5-30 Vacuum Leakage Test

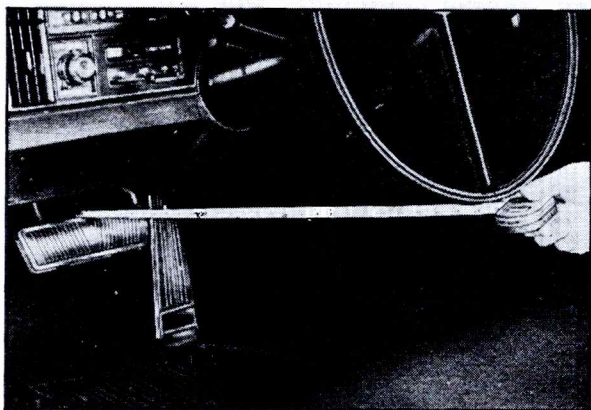


Fig. 5-31 Checking Brake Pedal Height

force (the effort required for a moderate stop). While holding pedal force as constant as possible, note vacuum gage reading immediately after applying brake and one-half minute later.

5. Immediate reading should not be more than four inches of mercury less than initial reading taken after closing shut-off valve. Subsequent drop in vacuum reading while holding brakes applied should not exceed two inches of mercury per 1/2 minute. If vacuum leak exceeds specification, power unit must be serviced.

b. Master Cylinder Section

NOTE: These tests will not determine all master cylinder malfunctions. Use the diagnosis chart to help isolate the problem if it is not resolved by these tests.

1. Check for a cracked master cylinder casting or brake fluid around master cylinder to front vacuum seal. Leaks are indicated only if there is at least a drop of fluid. A damp condition is normal.

2. Depress brake pedal. A geyser should be seen at front reservoir as the brake pedal is first depressed.

a. If system fails this test, check for a binding pedal linkage and incorrect push rod adjustment. If both of these are satisfactory, disassemble the master cylinder and check for swollen or elongated primary piston seal(s). Also see Note 25.

c. Brake Leaks

1. With engine running at idle and transmission in Neutral, depress brake pedal and hold foot pressure on pedal. If pedal gradually falls away under foot pressure, hydraulic system is leaking.

NOTE: Hydraulic system may be leaking internally as well as externally. See part b, Steps 1 and 2. Also system may appear to pass this test but still have slight leakage.

d. Excessive Pedal Travel

1. On cars equipped with Tilt and Telescope steering column, place wheel in third position from top.

2. Hook end of tape over top edge of brake pedal pad, at approximately the center of the pad.

3. Unreel tape to rim of steering wheel, Fig. 5-31.

4. Place thumbnail at edge of wheel and take a reading of the extended length.

5. While holding tape, and with engine idling, press pedal with estimated 20-30 pounds force (the effort required for a moderate stop), and note reading on tape measure. The difference between the two readings is the amount of pedal travel.

Pedal travel should not exceed 1-7/8 inch on all cars except 693 which should not exceed 2 inches.

6. If pedal travel is greater than specification, the system most likely has air in the lines and should be bled. It may be necessary to bleed the system several times at each fitting. See Note 8.

Be sure to tap the calipers with a plastic head hammer in the area of the piston(s) to dislodge air bubbles while bleeding. If pedal travel exceeds specification, there may still be some air in the system.

Other less frequent causes of excessive pedal travel are rear brake shoe adjusters not functioning, shoes require relining, front or rear hydraulic system has lost its fluid, and tapered linings.

e. Road Testing Brakes

Brakes should be tested on dry, clean, smooth and reasonably level roadway which is not crowned. Road test brakes by making brake applications with both light and heavy pedal forces at various speeds to determine if car stops evenly and effectively.

Also drive car to see if it leads to one side or the other without brake application. If it does, check tire pressure, front end alignment and front suspension attachments for looseness. See diagnosis chart for other causes.

26. Testing Brake Tell-Tale Light Operation

1. Start engine but do not apply brake pedal. While ignition switch is in start position, the brake tell-tale light should glow and go off when the ignition switch returns to ignition position.

2. If system performs as described, proceed to Step 5.

3. If light fails to glow in start position, perform electrical tests outlined in Section 12, Note

4. If light does not go out with ignition switch in ignition position, proceed as follows:

a. Perform electrical tests outlined in Section 12, Note

b. If defect is not found, see if condition occurs only when lead is connected to the distributor and switch assembly with ignition switch in ignition position. If so, replace switch and bleed system.

5. Depress brake pedal. Brake light should not light and pedal should not be low.

6. If system performs as described above, system is all right.

7. If brake light glows and pedal height is low, check for all conditions listed in diagnosis chart on page 5-

27. Substandard or Contaminated Brake Fluid

Improper brake fluid or mineral oil in the fluid may cause the brake fluid to boil or the rubber components in the hydraulic system to deteriorate.

When checking the fluid reservoir level, the level in the front reservoir may be as low as one inch from the top on disc brake cars if the

front linings are worn. This is not abnormal.

To check for deterioration of rubber parts, perform Step 2 of Note 26c. If primary piston cups are swollen, then rubber parts have deteriorated. This deterioration may also be evidenced by swollen wheel cylinder piston cups on the drum brake wheels.

If deterioration of rubber is evident, disassemble all hydraulic parts and wash with alcohol. Dry these parts with compressed air before assembly to keep alcohol out of system. Replace all rubber parts in system including hoses. Also when working on the brake mechanisms, check for fluid on linings. If fluid is found, replace linings.

If master cylinder piston seals are all right, check for all leakage or excessive heating conditions. If condition is not found and still in doubt, drain fluid, flush with brake fluid, refill and bleed system.

1969 BRAKE DIAGNOSIS CHART

NOTE: Operation of Tell-Tale Brake Light may be checked as outlined in Note 26.

CAUSE	Symptom	Excessive Brake Pedal Travel	Brake Pedal Travel Gradually Increases	Excessive Brake Pedal Effort	Excessive Braking Action	Brakes Slow to Respond	Brakes Slow to Release	Brakes Drag	Uneven Braking Action (Side to Side)	Uneven Braking Action (Front to Rear)	Scraping Noise from Brakes	Brakes Squeak During Application	Brakes Squeak During Stop	Brakes Chatter (Roughness)	Brakes Groan at End of Stop	Brakes Tell-Tale Glows During Stop
Leaking Brake Line or Connection		X	XX	X						X						XX
Leaking Wheel Cylinder or Piston Seal		X	XX	X	X				X							X
Leaking Master Cylinder		X	XX	X												X
Air in Brake System		XX		X						X						XX
Contaminated or Improper Brake Fluid		X				X	X	X								X
Leaking Vacuum System				XX		X										
Restricted Air Passage in Power Head			X	X		XX	X									
Damaged Power Head				X	X	X	X	XX								
Worn Out Brake Lining				X	X				X	X	X	X	X		X	
Uneven Brake Lining Wear - Replace		X			X				X	X	X	X	XX		X	X
Glazed Brake Lining - Sand				XX		X			X	X		X	X			
Incorrect Lining Material - Replace				X	X				X	X			X		X	
Contaminated Brake Lining - Replace					XX				XX	XX	X	X	X		X	
Linings Damaged by Abusive Use - Replace				X	XX				X	X	X	X	X		X	
Excessive Brake Lining Dust - Remove with Air				X	XX				XX	XX		X	XX		X	
Heat Spotted or Scored Brake Drums or Discs					X				X	X		X	X	XX	X	
Out-of-Round or Vibrating Brake Drums													X	XX		
Out-of-Parallel Brake Discs		X												XX		
Excessive Disc Run-Out		X												X		
Faulty Automatic Adjusters		X						X	X	X						X
Incorrect Wheel Cylinder Sizes				X	X				X	X						
Weak or Incorrect Brake Shoe Retention Springs					X		X	XX	X	X	XX	X	XX			
Brake Assembly Attachments - Missing or Loose		X						X	X	X	X		X	X	X	
Insufficient Brake Shoe Guide Lubricant						X	X	X	X	X	XX	XX				
Restricted Brake Fluid Passage or Sticking Wheel Cylinder Piston			X	X		X	X	X	X	X						X
Faulty Metering Valve		X		X	X	X	X	X		X						X
Faulty Proportioning Valve (Eldorado Disc Only)				X	X	X	X	X		X						
Brake Pedal Linkage Interference or Binding				X		X	XX	XX								
Improperly Adjusted Parking Brake								X								
Improperly Adjusted Master Cylinder Push Rod		X					X	XX								X
Incorrect Front End Alignment									XX							
Incorrect Tire Pressure									X	X						
Incorrect Wheel Bearing Adjustment		X									X			X		
Loose Front Suspension Attachments								X	X		XX			X	X	
Out-of-Balance Wheel Assemblies														XX		
Incorrect Body Mount Torque														X		
Need to Slightly Increase or Decrease Pedal Effort															XX	
Operator Riding Brake Pedal				X				X		X					X	
Sticking Caliper or Wheel Cylinder Pistons								XX								

XX - Indicates more probable cause(s)

X - Indicates other causes

TORQUE SPECIFICATIONS

Material Number	Application	Size	Foot-Pounds
Special	Pipe Nut to Master Cylinder.	1/2 -20 or 9/16-18	25 Max.
Special	All Other Brake Pipe Nuts.	3/8 -24, 7/16-24, 1/2 -20	20 Max.
260M	Parking Brake Cable Clamps (at Backing Plate)	5/16-24	11
Special	Brake Hose to Caliper	7/16-20	30 Max.
Special	Brake Hose to Brass Connectors	7/16-20	20 Max.
300M	Brake Backing Plate to Rear Axle Housing. . .	3/8 -24	40
300M	Front Brake Anchor Pin to Knuckle	9/16-18	100
284M	Brake Unit to Cowl.	3/8 -24	13
286M	Brake Pedal Pivot Bolt	7/16-24	15
286M	Master Cylinder to Vacuum Power Head	3/8 -24	20
Special	Caliper to Support Plate Bolt	Special	30
Special	Piston Extension Screw	Special	90*
Special	Floating Piston Stop Bolt	10-24	30*
*Inch-Pounds			

NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings and steel classifications.

SPECIFICATIONS

Item	All Series Except 693 Unless Otherwise Noted		
Swept Braking Area (in square inches)			
Front			241
Rear			189
Lining Area (in square inches)			
Front			42
Rear			117
Wheel Cylinder Bore			
Rear - 680, 681, 682 and 683.			13/16"
Rear - 697			7/8"
Rear - 698			15/16"
Drums (inside diameter)			12.00"
Remachined Drum Diameter (maximum)			12.060"
Variations of Inside Drum Diameter (maximum) . . . . .			.0015"
Run-Out of Inside Drum Diameter (maximum) . . . . .			.005"
Clearance Between Secondary Linings and Drums . . . . .			.010" - .030"
Lateral Run-Out of Disc . . . . .			.0025"
Flatness and Parallelism Between Frictional Surfaces of Disc . . . . .			.0007"
Lining Size (length, width, thickness in inches)			
Front	Inner Shoe	5.4 x 1.93 x .43	
	Outer Shoe	5.4 x 1.93 x .41	
Rear Primary			
680, 681, 682 and 683		11.00 x 2.50 x .24	
697, 698		11.00 x 2.50 x .26	
Rear Secondary			
680, 681, 682 and 683		12.36 x 2.50 x .26	
687, 698		12.36 x 2.50 x .28	
Lining to Shoe Attachment Method			Rivets
Metering Valve			
Cut-in Pressure			155 psi
Blend Pressure			700 psi

GENERAL INFORMATION

NOTE: The following information pertains only to the Fleetwood Eldorado.

The braking system used on the 1969 Fleetwood Eldorado consists of power-assisted, hydraulic front and rear service brakes and a foot-operated, vacuum-released parking brake that applies the brake shoes at the rear wheels through mechanical linkage.

Single piston sliding caliper front disc brakes and rear drum brakes are used on the Fleetwood Eldorado.

Delco-Moraine Tandem Power Brake Unit

The Delco-Moraine tandem diaphragm power brake unit used on 693 Series cars consists of a tandem diaphragm vacuum power section and a dual hydraulic master cylinder.

The tandem diaphragm vacuum power unit consists of a front and rear shell, a housing divider, a front and rear diaphragm and plate assemblies, a hydraulic push rod, and a diaphragm return spring, Fig. 5-2.

The unit operates so that two diaphragm and plate assemblies utilize the differential pressure created by engine intake manifold vacuum and atmospheric pressure to assist the hydraulic push rod.

The master cylinder used with the tandem booster is basically the same as that used with the single diaphragm unit.

Single Piston Sliding Caliper Front Disc Brakes

The single piston sliding caliper front disc brake used on the Fleetwood Eldorado is serviced in the same manner as those installed on other

Cadillac cars. The following items are distinctive to the Fleetwood Eldorado.

Hub and Disc

Hub and Disc Assembly utilize an 11" diameter loose mounted disc.

Caliper

Caliper utilizing a 2-15/16" diameter piston.

Metering Valve

The metering valve is located on a bracket attached to the power brake unit and is installed in the hydraulic line to the disc brake caliper. One line connects it to the front outlet of the power brake unit and the other to the distributor and switch assembly.

Proportioning Valve

The proportioning valve, located on a bracket on the left side rail of the frame is installed in the hydraulic line between the distributor and switch assembly and the rear wheel cylinders. The proportioning valve serves to limit the fluid pressure to the rear wheel cylinders to provide a balanced braking.

Distributor and Switch Assembly

A distributor and switch assembly is on a bracket on the left frame side rail behind the upper control arm. There are five lines connecting the assembly into the hydraulic system. The three front lines are connected into the front hydraulic system, with one line leading to the metering valve and lines leading to each of the front caliper assemblies. The two rear lines are connected in the rear hydraulic system with one line leading to the master cylinder rear outlet and the other to the proportioning valve.

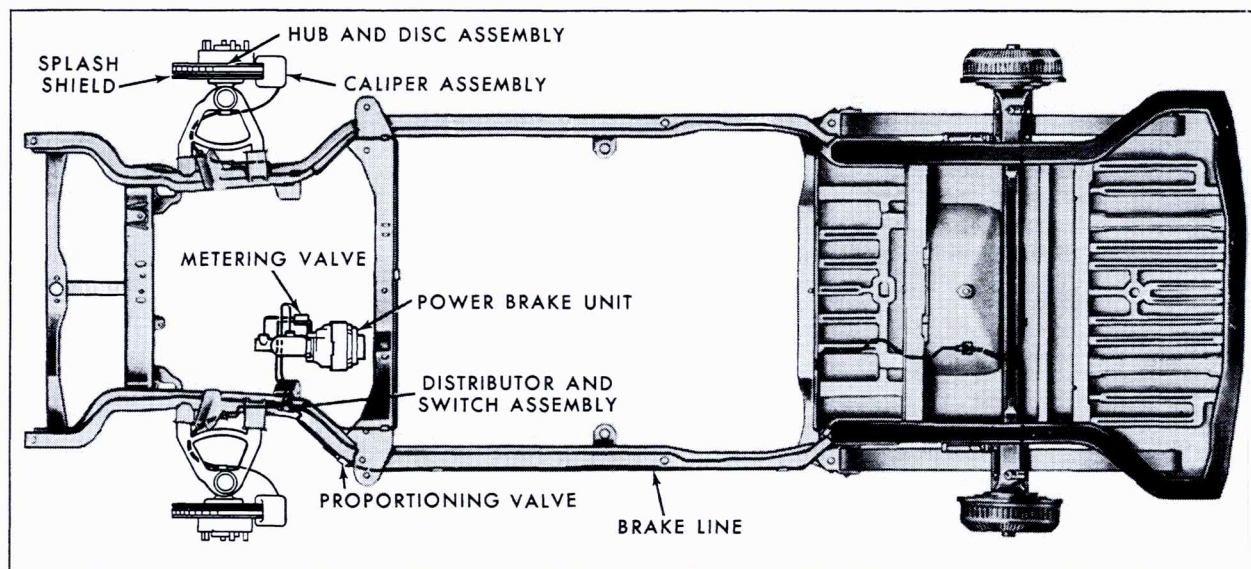


Fig. 5-32 Location of Components - Eldorado

SERVICE INFORMATION

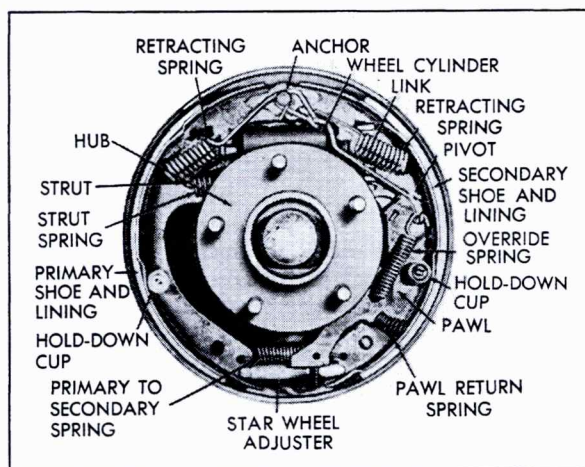


Fig. 5-33 Drum Brake Mechanism

NOTE: The service information that follows pertains only to the Fleetwood Eldorado. For service procedures not given, refer to the forward portion of this section, as these procedures are the same as for the other 1969 Cadillac models.

28. Relining Rear Drum Brakes

When brake relining is necessary, it is recommended that the complete brake lining and shoe assemblies be replaced with new assemblies. New lining and shoe assemblies are precision-ground to fit the drum diameter, minimizing the possibility of imperfect braking action due to warped brake shoes or partial contact between linings and drum. This simplifies the complete relining operation and insures a satisfactory job for the customer.

Those Service Departments that have adequate brake shoe relining equipment may obtain linings, drilled and cut to size, from their servicing Parts Warehouses. Brake lining grinding equipment should incorporate brake shoe holders that locate the shoes accurately in relation to the anchor end, as brake anchors are not adjustable and require accurately ground linings.

1. Release parking brake, raise car, and remove rear wheels and drums. A clip nut on one wheel stud retains the drum to the hub during removal.

CAUTION: When handling brake drums, be extremely careful not to drop the drum or get brake fluid or grease on frictional surface.

2. Loosen parking brake cable locknut at equalizer.

3. Remove primary brake shoe retracting spring, using Brake Spring Remover and Installer, J-8049.

4. Disconnect link at anchor, using Brake Spring Remover and Installer, J-8049, and remove link, secondary brake shoe retracting spring, and anchor plate.

5. Remove primary brake shoe hold-down cup, spring, washer and pin, and secondary brake shoe hold-down cup, spring, pin and sleeve.

6. Remove pivot pawl and override spring as an assembly, and remove pawl return spring.

7. Spread brake shoes and remove parking brake strut rod and spring.

8. Remove parking brake operating lever from secondary brake shoe and remove shoe and lining assemblies from brake backing plate.

9. Remove star wheel adjuster and primary-to-secondary connecting spring from brake shoes.

10. Clean brake backing plate and all brake parts.

CAUTION: To avoid the possibility of brake "grab" and "pull", make certain that hands are clean when handling brake parts. Avoid handling friction surfaces of drums and linings.

11. Torque nuts that hold backing plate to rear spindle to 40 foot-pounds maximum torque.

12. Lubricate threads and socket of star wheel adjuster and points of contact between brake shoes and other brake parts with special heat resistant lubricant, available from servicing Parts Warehouses. Use sparingly, especially on brake shoe pads.

13. Thread star wheel adjusting screw completely into pivot nut to permit installation of brake drum over replacement brake shoes.

14. Install star wheel adjuster and primary-to-secondary connecting spring on replacement brake shoes.

NOTE: Star wheel adjusters with three wide grooves on O.D. of pivot nut (left hand thread) are installed on right side of car, while those with three narrow grooves (right hand thread) on O.D. of pivot nut are installed on left side of car. Incorrect installation of star wheel pivot nuts will result in automatic adjusters loosening rather than tightening brakes.

15. Install parking brake operating lever on secondary brake shoe and position shoe and lining assemblies to brake backing plate.

16. Install parking brake strut rod and spring on brake shoes.

NOTE: Spring is positioned against primary brake shoe with spring tab outside of brake shoe web.

17. Engage brake shoes with wheel cylinder connecting links and install primary brake shoe hold-down pin, washer, spring (green) and cup.

18. Install anchor plate and position pivot, pawl and override spring as an assembly to secondary brake shoe.

19. Install link and pawl return spring and secure all parts to secondary brake shoe by installing hold-down sleeve.

20. Install secondary brake shoe hold-down pin, spring (maroon) and cup.

21. Install primary brake shoe retracting spring (grey) using Brake Spring Remover and Installer, J-8049.

22. Install secondary brake shoe retracting spring (blue) using Brake Spring Remover and Installer, J-8049.

23. Install rear brake drums and clip nut retaining drum to hub.

24. Perform manual service brake adjustment.

25. Adjust parking brake as described in Note 2.

26. Install rear wheels and lower car.

29. Wheel Cylinder Servicing (Drum)

a. Removal

1. Raise car and remove wheel and brake drum. Blow out dust and dirt from drum and backing plate, being careful not to blow dirt into wheel bearing area.

2. Disconnect piping from wheel cylinder.

3. Remove brake shoe retracting springs and link.

4. Remove two screws and lockwashers securing wheel cylinder to backing plate.

5. Disengage wheel cylinder connecting links from brake shoes and remove wheel cylinder.

CAUTION: Be sure brake fluid does not drip on brake linings.

b. Disassembly, Cleaning and Assembly

The procedure for disassembly and cleaning of the wheel cylinder is described in Notes 7b, 7c, and 7d, respectively.

c. Installation

1. Position wheel cylinder to brake backing plate, slipping cylinder-to-shoe connecting links in place at same time.

2. Install two screws and lockwashers securing wheel cylinder to backing plate. Tighten to 15 foot-pounds maximum torque.

3. Install link, and retracting spring.

4. Connect brake piping.

5. Install brake drum and wheel assembly and bleed all brakes as described in Note 8.

6. Lower car.

30. Disc Assembly— Removal and Installation

a. Removal

1. Raise car and remove front wheel.

2. Remove two bolts which hold caliper to support plate.

NOTE: It is not necessary to remove brake hose from caliper when removing disc for service.

3. Slide caliper off disc and support by a hook-shaped wire fastened to the upper control arm.

CAUTION: Do not allow caliper to hang from brake hose.

4. Mark a wheel stud and a corresponding place on the disc to assist in installation.

5. Remove the disc by sliding it off the hub.

b. Installation

1. Inspect hub flange and disc mating surfaces to make sure that they are free of dirt and other foreign material. Clean as required.

2. If re-installing original disc, align index marks on hub and disc and slide disc over hub pilot diameter, making sure that disc is seated against hub flange.

NOTE: If disc replacement is necessary, the new disc may be assembled to the hub in any position. It is not necessary to replace both discs if one is all right.

3. Position caliper on disc and line up holes in caliper ears with holes in support plate. Make sure brake hose is not twisted when caliper is attached to support plate.

4. Wipe all dirt and corrosion from the caliper mounting bolts. Do not use abrasives, as they will remove protective plating. Lubricate smaller ends of bolts with silicone lubricant.

5. Start either bolt into the inboard ear of the caliper and into the support plate. At this point it is necessary to be sure that the bolt passes under the retaining ear on the inboard shoe to maintain the shoe in position in the caliper, Fig. 5-12.

6. Pass the bolt on through the outboard ear on the caliper until the threads on the bolt can be started into the mounting bracket.

7. Repeat steps 5 and 6 in placing remaining bolt into caliper assembly.

8. Tighten caliper mounting bolts to 25 to 35 foot-pounds.

9. Install wheels, tighten wheel mounting nuts to 90-120 foot-pounds, and lower car.

10. Before moving the vehicle, pump the brake pedal two or three times to insure firm pedal.

31. Servicing Discs

In manufacture, disc tolerance for flatness and parallelism is held to .0005 inch and the finish of the frictional surfaces must be maintained to 15-80 micro inches. Field methods are not sufficiently accurate to achieve the above dimensions.

Scoring of the disc brake rotor, due to advanced wear of linings, does not always necessitate replacement of the rotor. Rotors with scoring of the surface, up to approximately .020 inch in depth, are not detrimental to brake operation and may be used with new linings.

When new linings are installed, the rotor should be lightly sanded. A slight ridge of rust

may form on the edge of the disc, during normal use. This ridge should be removed during the above sanding operation.

In normal servicing of worn lining or on caliper removal, lateral runout of the rotor need not be checked, except when brake shudder is evident.

If brake shudder develops after long periods of use, it could be due to light surface deposits (such as lining oxides) on the brake surface of the rotor. These deposits, which appear on the rotor as dark blotches about the size of half-dollars, may be removed by sanding.

Brake shudder on low mileage cars can be due to excessive rotor lateral runout or out-of-parallelism.

On the Eldorado, lateral runout of the hub and disc assembly must not exceed .008 inch or parallelism in excess of .0005 inch. When checking for lateral runout, it is necessary that the wheel nuts be installed with the flat portion of the hex against the disc to retain the disc against the hub.

In addition, when performing any service on front disc brakes, inspect the rotor ventilation passages for obstructions, such as salt or mud build-up. Any build-up must be removed because it decreases brake cooling, which might lead to increased lining wear rate and brake shudder.

32. Proportioning Valve

NOTE: The proportioning valve is a non-adjustable, non-serviceable valve. If defective

a. Removal

1. Disconnect brake lines from proportioning valve.
2. Remove screw securing proportioning valve mounting clip to left frame side rail and remove proportioning valve.

b. Installation

1. Position proportioning valve to brake lines, and loosely start tube nuts into proportioning valve.
2. Install mounting bracket and screw retaining proportioning valve to frame side rail.
3. Tighten brake line tube nuts to 20 foot-pounds maximum torque.
4. Bleed brakes as described in Note 8.

33. Metering Valve

NOTE: The metering valve is a non-adjustable, non-serviceable valve. If defective it must be replaced.

a. Removal

1. Disconnect brake lines from metering valve.
2. Remove two screws securing metering valve to mounting bracket and remove metering valve.

b. Installation

1. Install metering valve to mounting bracket

with two screws. Tighten screws to 20 in. lbs. maximum.

2. Start brake line tube nuts into metering valve.

NOTE: Metering valve inlet port is identified by the letter "M" and outlet port by the letter "F".

3. Tighten brake line tube nuts to 20 foot-pounds maximum torque.
4. Bleed brakes as described in Note 8.

34. Distributor and Switch Assembly

NOTE: The distributor and switch assembly is non-adjustable and non-serviceable. If defective it must be replaced.

a. Removal

1. Disconnect electrical lead from terminal on assembly.
2. Disconnect brake lines from distributor and switch assembly.
3. Remove bolt securing mounting bracket to frame and remove assembly with mounting bracket attached.

b. Installation

1. Position distributor and switch assembly with mounting bracket attached to frame and loosely install retaining screw.
2. Start all brake line tube nuts into their respective holes in distributor and switch assembly.
3. Tighten screw securing assembly to frame.
4. Tighten brake line tube nuts to 20 foot-pounds maximum torque.
5. Bleed brakes as described in Note 8.

35. Servicing Hydraulic Brake Hoses and Piping (Fig. 5-32)

Hydraulic pressure is transferred to the wheel cylinders through steel brake piping, and flexible hoses, Fig. 5-32.

The steel brake lines and flexible hoses should be inspected every spring and fall for damage that may occur from various road hazards.

While the flexible hoses and steel piping require no periodic servicing, it may be necessary to replace damaged hoses or piping in the following manner:

a. Removal—(Front Wheels)

1. Disconnect steel brake line from hose at frame bracket by turning steel tube fitting out of hose fitting. Cap fitting to prevent dirt from entering brake line.
2. Remove U-shaped retainer from hose fitting at frame support bracket and remove hose from bracket.
3. Remove cotter pin and nut securing upper

ball joint to knuckle and remove clip securing brake hose to ball joint stud.

4. If right front hose is being replaced, remove clip retaining hose to frame.

5. Turn hose out of inlet fitting of caliper and remove and discard copper gasket. If hose is to be reused, cap end fittings to prevent dirt from entering hose.

b. Installation—(Front Wheels)

1. Install new copper gasket on caliper end of hose (male end).

2. Tighten hose in caliper inlet to 30 foot-pounds maximum torque.

CAUTION: Never tighten hose in wheel cylinder inlet with hose attached at frame end, as this will twist the hose.

3. Install brake hose clip on upper ball joint stud and install ball joint retaining nut on stud. Tighten ball joint nut finger tight.

4. With suspension in normal position (front wheels straight ahead and front suspension at normal standing height) pass female end of hose through frame support bracket, allowing hose to seek its own position. Insert hex of hose fitting into the 12-point hole in support bracket in the position that will result in least twisting of hose.

NOTE: Do not twist hose any more than necessary during this operation as its natural curvature is essential to maintain proper hose-to-suspension clearance through full movement of suspension, steering and driving parts.

5. Install U-shaped retainer to secure hose to frame support bracket.

6. Inspect by turning wheels from stop-to-stop while observing hose position. Be sure that hose does not touch any other part at any time during steering travel. If contact does occur, remove hose retainer, and if necessary loosen upper ball joint nut, and reposition hose as necessary. Replace retainer, tighten ball joint nut finger tight, and reinspect.

7. When hose is properly positioned, torque ball joint nut to 40 foot-pounds minimum.

NOTE: If cotter pin cannot be installed, tighten nut to next hole and install cotter pin.

CAUTION: When installing cotter pin, make sure ends of pin are pinched tight against flat of nut. DO NOT let end of cotter pin extend down toward outer drive axle seal.

8. If right front hose is being replaced, install clip securing hose to frame.

9. Install steel brake line fitting into brake hose at frame support bracket and tighten fitting to 20 foot-pounds maximum torque.

10. Bleed brakes as described in Note 8.

c. Removal—Hydraulic Brake Piping (Rear Wheels)

1. Disconnect steel brake piping at rear wheel

cylinder fitting. Cap fitting to prevent dirt from entering wheel cylinder.

2. Disconnect brake piping at brake line junction fitting on rear axle.

3. If left brake piping is being removed, remove clip retaining piping to rear axle and remove piping.

4. If right brake piping is being removed, remove three clips, and remove piping.

d. Installation—Hydraulic Brake Piping (Rear Wheels)

1. Position brake piping to rear axle.

a. If right brake piping is being installed, install three clips, two spring and one bolted, retaining piping to rear axle.

b. If left brake piping is being installed, install one spring clip retaining piping to rear axle.

NOTE: Use new spring clips when securing piping to rear axle.

2. Connect piping to brake line junction fitting on rear axle, tightening to 20 foot-pounds maximum torque.

3. Connect brake piping to rear wheel cylinder fitting, tightening fitting to 20 foot-pounds maximum torque.

4. Bleed all brakes as described in Note 8.

e. Removal—Hydraulic Brake Hose (Rear Wheels)

1. Remove retainer securing forward end of brake hose to underbody bracket.

2. Disconnect steel brake pipe from hose. Cap pipe.

3. Remove bolt from junction block on axle.

4. Disconnect rear axle piping from junction block. Cap pipes.

f. Installation—Hydraulic Brake Hose (Rear Wheels)

1. Connect rear axle piping to junction block. Tighten fittings to 20 foot-pounds maximum torque.

2. Bolt junction block to axle.

3. Pass female end of hose through mounting bracket, allowing hose to seek its own position.

4. Place steel tube connector in hose fitting and tighten to 20 foot-pounds maximum torque.

CAUTION: Do not allow hose to twist out of its normal position.

5. Install retainer to secure hose to underbody bracket.

6. Bleed all brakes as described in Note 8.

36. Parking Brake Cables

a. Front Cable

The procedure for removing and installing the front parking brake cable is described in Note 21a and 21b respectively.

b. Removal—Rear Cable

1. Release parking brake.
2. Raise rear of car and position on jack stands.
3. Remove rear wheels and drums.
4. Remove rear equalizer nut and separate equalizer from front cable.
5. Remove cable from equalizer.
6. Remove U-shaped clips retaining parking brake cable to underbody brackets on right and left sides.
7. Remove wire guides retaining brake cable to rear axle at center spring clamp.
8. Remove cable ends from parking brake operating levers, and remove cable ends from backing plates.

c. Installation—Rear Cable

1. Install cable ends through backing plates and connect to parking brake operating levers.

CAUTION: Pull on center of cable and check operation of cable and brake mechanisms.

2. Routing cable toward center of car, install wire guides retaining cable to rear axle at center spring clamp.
3. Position brake cable to underbody brackets on right and left sides of car, and secure with U-shaped clip.
4. Install cable in equalizer and brush small amount of lubricant in equalizer slot.
5. Insert front cable stud through equalizer hole, and install rear equalizer nut.
6. Install rear drums and wheels.
7. Adjust parking brake as described in Note 2.

37. Parking Brake Assembly

a. Removal

1. Release parking brake and place transmission shift lever in Park position.
2. Working underneath car, remove equalizer nut and separate front cable stud from equalizer.
3. Working in engine compartment, remove two nuts securing parking brake assembly to cowl.
4. Remove steering column lower cover as described in Section 12, Note 45a.
5. Position carpet and left cowl kick-pad out of the way.
6. Disconnect vacuum hose from parking brake diaphragm.
7. Remove two bolts retaining parking brake assembly to instrument panel.
8. Moving assembly away from cowl, position assembly so that clevis is exposed and remove cable end from clevis.

b. Installation

1. Position parking brake assembly so that clevis is exposed and attach parking brake cable end to clevis.
2. Position parking brake assembly to cowl and, from engine compartment, install two nuts retaining assembly to cowl.

3. Install two bolts retaining parking brake assembly to instrument panel.
4. Connect vacuum hose to parking brake vacuum cylinder.
5. Replace cowl kick-pad and carpet.
6. Insert front cable stud through equalizer, making sure that rear cables are properly routed through equalizer and secured at C-shaped clamp, Fig. 5-23.
7. Install equalizer nut.
8. Adjust parking brake as described in Note 2.
9. Check operation of parking brake.
10. Install steering column lower cover as described in Section 12, Note 45b.

38. Delco-Moraine Tandem Diaphragm Power Head Disassembly, Cleaning, Inspection and Assembly

a. Disassembly

NOTE: Scribe a mark on the top center of the front and rear housings in line with master cylinder reservoir cover to facilitate re-assembly.

1. Remove the master cylinder reservoir cover retainer, reservoir cover and diaphragm, and empty the brake fluid from the reservoirs. Pump the power brake push rod to remove fluid from the master cylinder bore.
2. Remove the two locknuts which hold the master cylinder to the front housing, and remove the master cylinder from its mounting studs. Remove the front housing seal from the front shell.

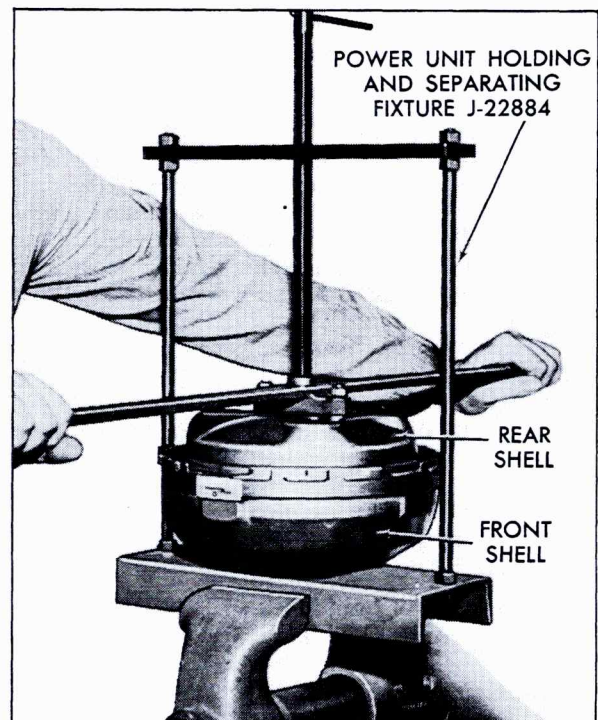


Fig. 5-34 Removing Rear Shell - Tandem Diaphragm

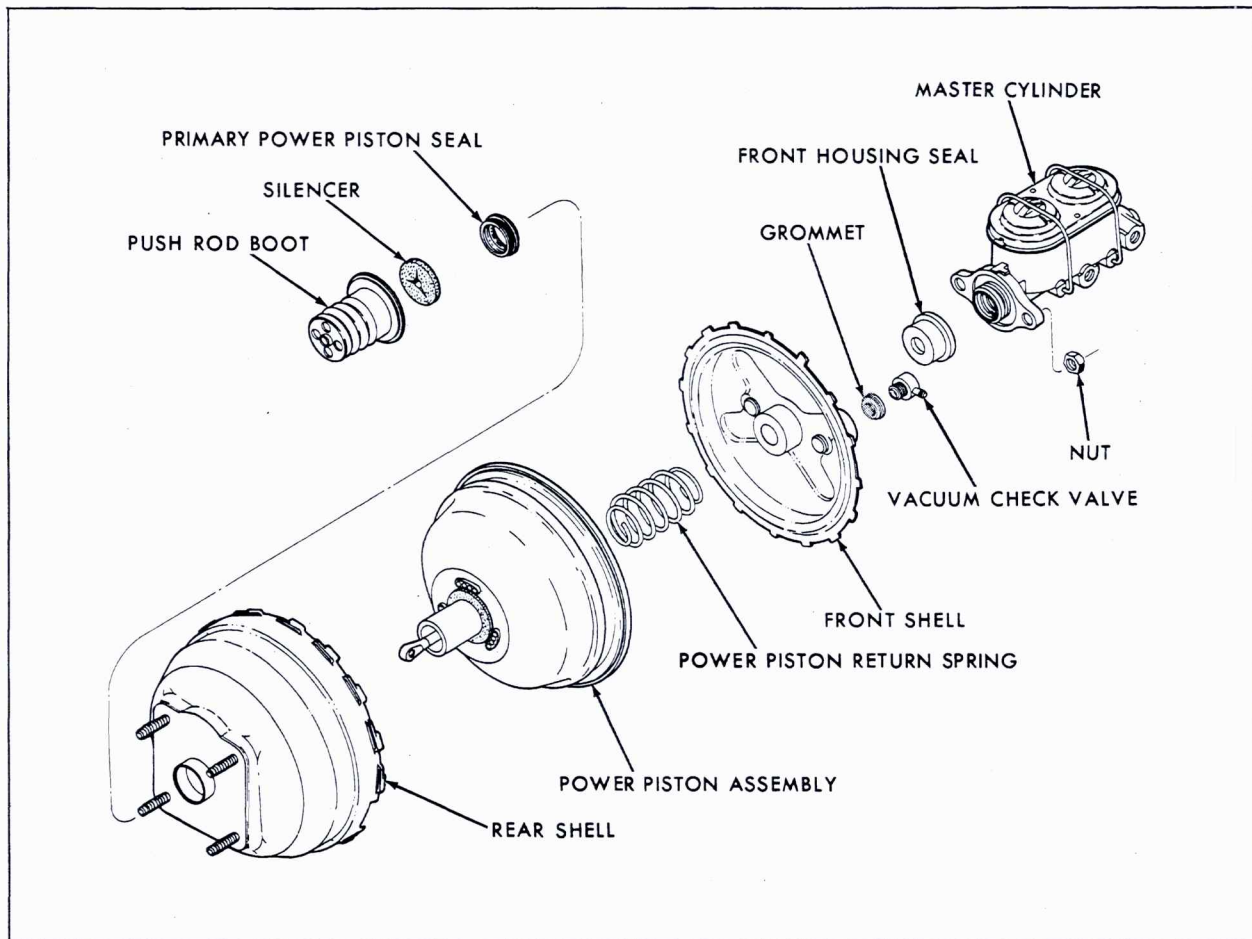


Fig. 5-35 Tandem Diaphragm Power Head Disassembled

NOTE: If Separating Fixture J-22884 is not available, use Separator J-9504. Do not remove master cylinder at this time if J-9504 is to be used.

3. Secure Power Unit Shell Holding and Separating Fixture, J-22884, and power head, as shown in Fig. 5-34. Studs on rear shell engage base of fixture and studs on front shell engage bar of tool with bar bearing against front shell. Secure front shell to bar with two master cylinder lock nuts.

4. Rotate bar counterclockwise and unlock shells.

5. Back off on hold down clamp sufficiently to remove front shell, return spring, retainer plate and piston rod retainer, Fig. 5-35.

CAUTION: Be careful when separating diaphragms that return spring does not fly out.

6. Remove assembly from holding fixture and remove J-22884 from vise.

7. Remove the dust boot retainer and boot from the rear housing and push rod. Remove the felt silencer from inside the boot.

8. Remove the power piston assembly from the rear shell and remove the primary power piston seal from the center opening of the rear shell.

9. Lift the bead on the outside diameter of the secondary diaphragm and remove the diaphragm support ring, Fig. 5-36.

10. Mount Holding Fixture, J-23101, in a vise with wide jaws up. Position the secondary power piston so that the two radial slots in the piston fit over the jaws of the tool, Fig. 5-37.

11. Fold back primary diaphragm from the outside diameter of the primary support plate. Grip the edge of the support plate and rotate counterclockwise to unscrew the primary power piston from the secondary power piston, Fig. 5-38.

NOTE: It is possible that the primary support plate will unlock from the primary piston before the primary piston unscrews from the secondary piston. If this happens, continue to turn the primary support plate counterclockwise. Tabs ("stops") on the primary support plate will temporarily lock the primary support plate to the primary power piston and permit continued counterclockwise rotation to unscrew the primary power piston from the secondary power piston.

12. Remove the housing divider from the secondary power piston. Remove the secondary power piston bearing from the housing divider.

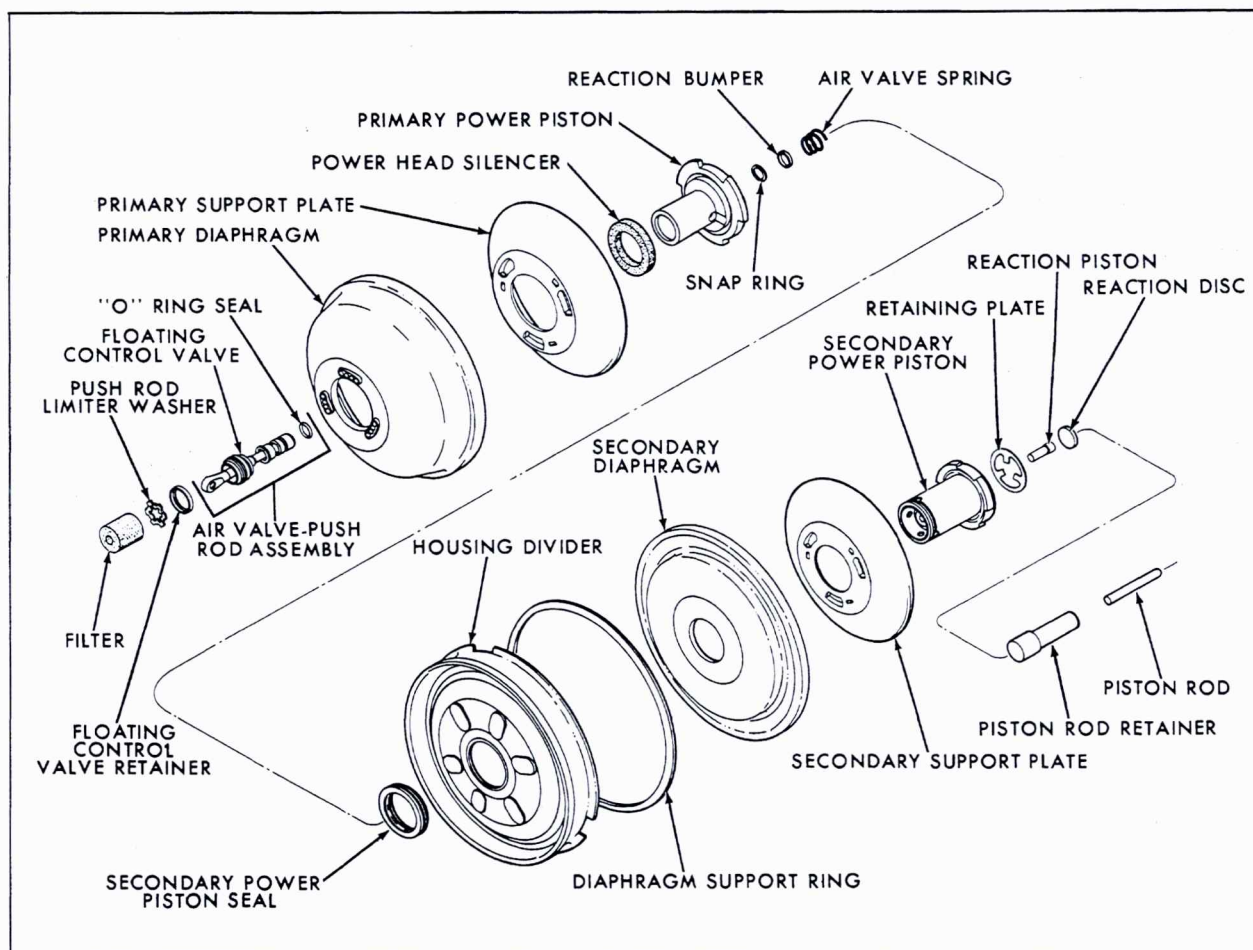


Fig. 5-36 Tandem Diaphragm Power Piston Disassembled

13. The secondary power piston should still be positioned on tool J-23101. Fold back secondary diaphragm from O.D. of secondary support plate. Grip the edges of the support plate and rotate clockwise to unlock the secondary support plate

from the secondary power piston, Fig. 5-39.

14. Remove the secondary diaphragm from the secondary support plate.

15. Remove the reaction piston and reaction disc from the center of the secondary power piston

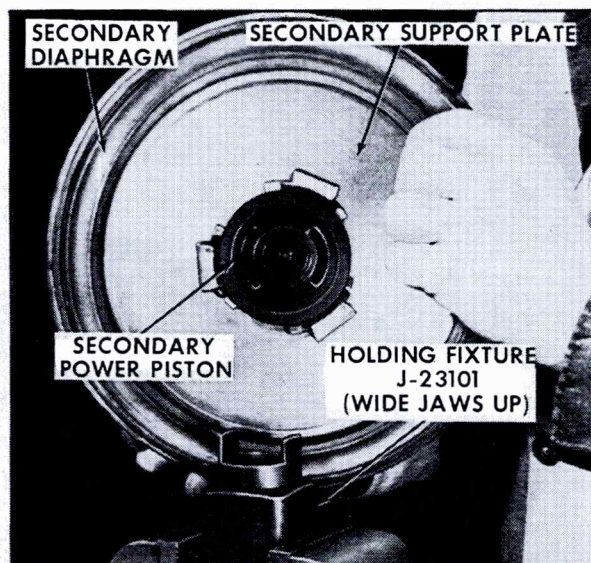


Fig. 5-37 Positioning Secondary Power Piston

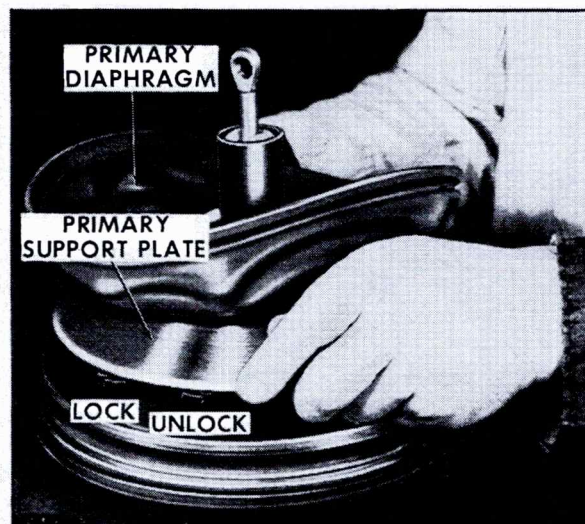


Fig. 5-38 Loosening Power Pistons

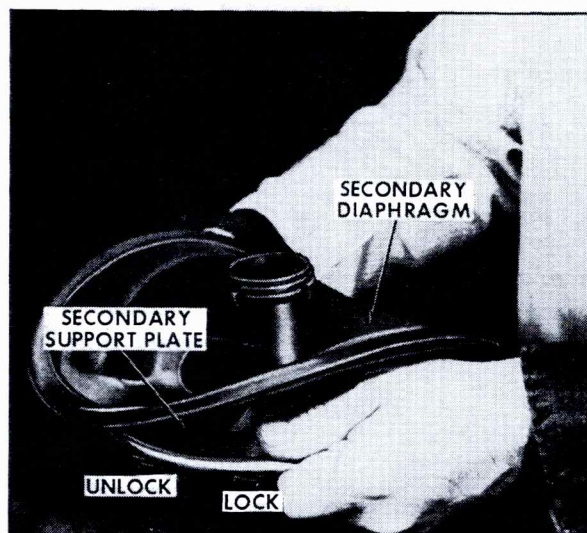


Fig. 5-39 Removing Secondary Diaphragm

by pushing down on the end of the reaction piston with a small object, such as a pencil, wooden dowel or metal rod, Fig. 5-40.

16. Remove the air valve spring from the end of the air valve (if it didn't come off during disassembly of the power piston).

17. Mount tool J-23101 in a vise with small jaws up. Position the primary power piston so that the two radial slots in the piston fit over the jaws of the tool, Fig. 5-41.

18. Fold back primary diaphragm from the support plate. Grip the edge of the support plate and rotate in a counterclockwise direction to unlock the primary support plate from the primary power piston, Fig. 5-42.

19. Remove the primary diaphragm from the primary support plate.

20. Remove the air filter and push rod limiter washer from the tubular section of the primary power piston, Fig. 5-36.



Fig. 5-40 Removing Reaction Piston

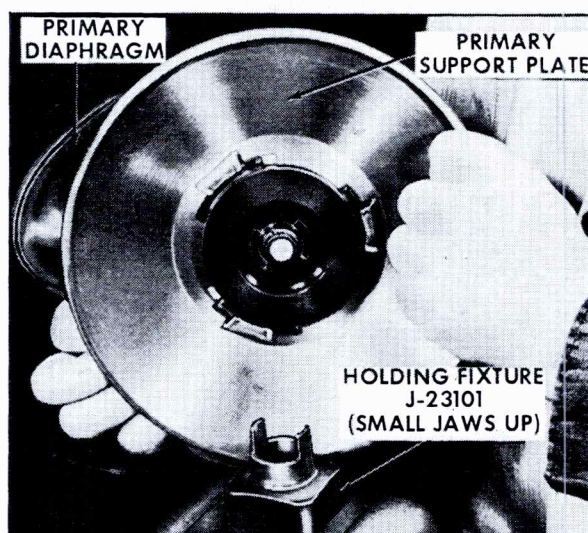


Fig. 5-41 Positioning Primary Power Piston

21. Remove the power head silencer from the neck of the power piston tube.

22. Remove the rubber reaction bumper from the end of the air valve.

23. Clamp eyelet end of air valve push rod in side of vise and using Truarc No. 2 pliers (J-4880), remove the snap ring from the air valve, Fig. 5-43.

24. Remove the air valve-push rod assembly from the tube end of the primary power piston by pulling on the primary power piston. A considerable force will be required.

25. Removal of the air valve push rod assembly will disassemble the control valve retainer.

26. Remove the "O" ring seal from the air valve.

27. The air valve push rod assembly will be serviced using a complete assembly, since the floating control valve cannot be removed over the eye end of the push rod.

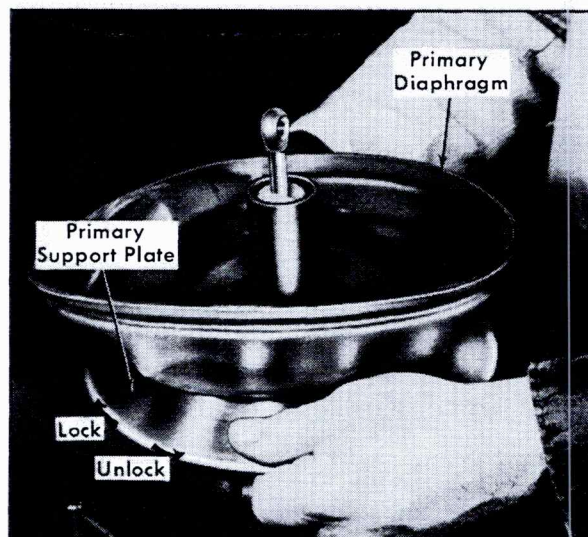


Fig. 5-42 Removing Primary Diaphragm

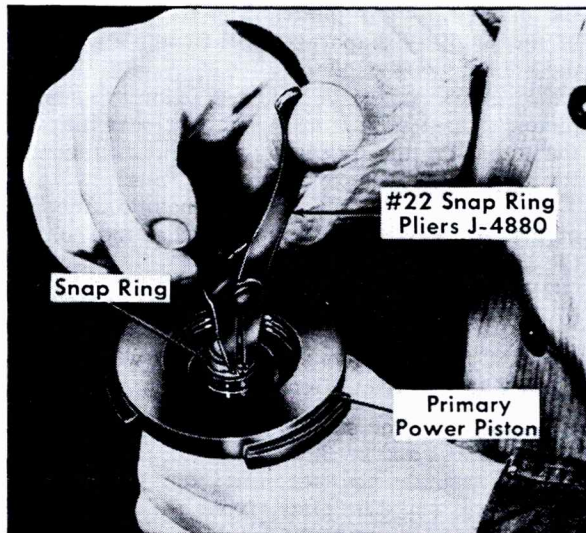


Fig. 5-43 Removing Snap Ring from Air Valve

b. Cleaning and Inspection

Perform cleaning and inspection procedures as described in Note 26b.

c. Assembly

1. Lubricate the I.D. and O.D. of the "O" ring seal, Fig. 5-36, with silicone lubricant and place on the air valve.

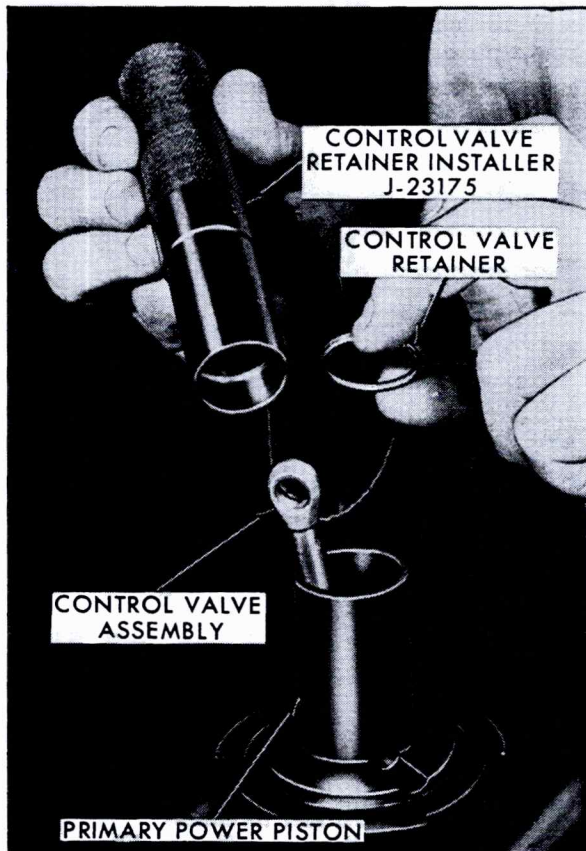


Fig. 5-44 Installing Retainer Ring

2. Wipe a thin film of silicone lubricant on the large and small O.D. of the floating control valve.

3. If the floating control valve needs replacement, it will be necessary to replace the complete air valve push rod assembly, since the floating control valve is a component part of this assembly and cannot be disassembled from the push rod.

4. Place the air valve end of the air valve push rod assembly into the tube of the primary power piston. Manually press the air valve push rod assembly so that the floating control valve bottoms on the tube section of the primary power piston.

5. Place the I.D. of the floating control valve retainer on the O.D. of floating control valve retainer installer J-23175. Place over the push rod so that the closed side of the retainer seats on the floating control valve. With Installer, J-23175, manually press the retainer and floating control valve assembly to seat in the primary power piston tube, Fig. 5-44.

6. After the floating control valve is seated, place the push rod limiter washer over the push rod and position on the floating control valve, Fig. 5-36.

7. The filter element can now be stretched over the push rod eye and pressed into the primary power piston tube, Fig. 5-36.

8. Using Truarc No. 2 pliers (J-4880), place the snap ring into the groove in the air valve, Fig. 5-43.

9. Position the rubber reaction bumper on the end of the air valve.

10. Tolerances of those component parts affecting output of the tandem power brake are very critical. In order to maintain correct power brake output, the power piston assembly must be gaged for selective fit of reaction piston whenever the primary power piston, and/or the secondary power piston are replaced during servicing. This gaging operation is not required if neither power piston is replaced during servicing.

If neither the primary power piston nor the secondary power piston has been replaced, proceed to step 19. If any of the above parts have been replaced, proceed with step 11.

11. Hand-tighten the secondary power piston to the primary power piston without the air valve spring.

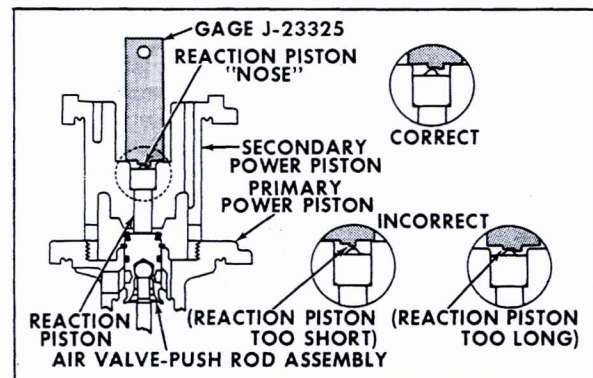


Fig. 5-45 Gauging Power Piston

12. Obtain three selective fit reaction pistons and insert one of the reaction pistons into its cavity in the secondary power piston. This is accomplished by placing the reaction piston, small diameter first, through the large cavity and into the smaller cavity.

13. With the secondary power piston pointing up, push on the reaction piston to insure that it is seated on the air valve.

14. While holding primary power piston in one hand, place Gage J-23325 in the secondary power piston so that the outer edges of the gage rest on the bottom of the large cavity, with the two gaging levels within the smaller reaction piston cavity, Fig. 5-45.

15. Move the gage to the left or right of the "nose" of the reaction piston. The correct size reaction piston is indicated when the "nose" of the piston "hits" the lower level of the gage and clears the higher level of the gage while permitting the outer edges of the gage to remain seated on the larger cavity of the secondary power piston, Fig. 5-45.

If the reaction piston is too long, the higher level of the gage will not clear the "nose" without moving the outer edges of the gage off the seat in the large cavity of the secondary power piston. If the reaction piston is too short, both levels of the gage will clear the "nose" of the reaction piston, Fig. 5-45.

NOTE: Care must be taken to insure that the gage is not "cocked".

16. Repeat steps 12 through 15 using a different reaction piston until the correct size piston is installed.

17. After determining the correct reaction piston, apply a light film of silicone lubricant to the O.D. of the rubber reaction disc. Place the rubber reaction disc in the large cavity of the secondary power piston and push the disc down to seat on the reaction piston.

18. Unlock the secondary power piston from the primary power piston and proceed with step 19.

19. Assemble the primary diaphragm to the primary support plate from the side of the support plate opposite the locking tangs, Fig. 5-36. Press the raised flange on the I.D. of the diaphragm through the center hole of the support plate. Be sure that the edge of the support plate center hole fits into the groove in the raised flange of the diaphragm. Lubricate the diaphragm I.D. and the raised surface of the flange (that fits into a groove in the primary power piston) with a light coat of silicone lubricant.

20. Mount Holding Fixture, J-23101, in a vise, small jaws up. Position the primary power piston so that the two radial slots in the piston fit over the jaws of the tool, Fig. 5-41.

21. Fold the primary diaphragm away from the O.D. of the primary support plate.

22. Holding the edges of the support plate, with the locking tangs down, place the primary support plate and diaphragm assembly over the tube of

the primary power piston. The flange on the I.D. of the primary diaphragm will fit into a groove in the primary power piston.

23. Grip the edges of the primary support plate, press down, and rotate clockwise until the tabs on the primary power piston contact the stops on the support plate, Fig. 5-42.

24. Place the power head silencer on the tube of the primary power piston so that the holes at the base of the tube are covered.

25. Apply a very light film of silicone lubricant to the O.D. of the primary power piston tube.

CAUTION: Excessive lubricant will contaminate and restrict silencer.

26. Remove the primary piston assembly from Tool J-23101 and lay it aside.

27. Assemble the secondary diaphragm to the secondary support plate from the side of the support plate opposite the locking tangs, Fig. 5-36. Press the raised flange on the I.D. of the diaphragm through the center hole of the support plate. Be sure that the edge of the support plate center hole fits into the groove in the raised flange of the diaphragm. Apply a thin coat of silicone lubricant to the I.D. of the secondary diaphragm and the raised surface of the flange (that fits into a groove in the secondary power piston).

28. Mount Tool J-23101 in a vise with large jaws up. Position the secondary power piston so that the radial slots in the piston fit over the jaws of the tool, Fig. 5-37. Apply a light coat of silicone lubricant to the tube of the secondary power piston.



Fig. 5-46 Installing Housing Divider

29. Fold the secondary diaphragm away from the O.D. of the secondary support plate.

30. Holding the edges of the support plate, with the locking tangs down, place the secondary diaphragm and support plate assembly over the tube of the secondary power piston. The flange on the I.D. of the secondary diaphragm will fit into the groove in the secondary piston.

31. Grip the edges of the secondary support plate, press down, and rotate counterclockwise until the tabs on the secondary power piston contact the stops on the support plate, Fig. 5-38. Fold the secondary diaphragm back into position on the secondary support plate. Leave the secondary power piston assembly on Tool J-23101 in the vise.

32. Apply a light coat of talcum powder or silicone lubricant to the bead on the O.D. of the secondary diaphragm. This will facilitate assembly of front and rear housings.

33. Place the secondary diaphragm support ring on the secondary power piston assembly so that it rests on the edge of the diaphragm.

34. Hold the housing divider so that the formed lip (that holds the primary diaphragm) of the divider faces down. Place the secondary seal in the I.D. of the divider so that the extended lip of the seal faces up.

35. Lubricate the I.D. of the secondary seal with silicone lubricant.

36. Position Secondary Seal Protector Tool, J-23188, on the threaded end of the secondary power piston, Fig. 5-46.

37. Hold the housing divider with the formed lip (that holds the primary diaphragm) facing up. Press the divider down over the tool and onto the secondary power piston tube where it will rest against the diaphragm support ring. Remove Seal Protector, J-23188, from secondary power piston; however, do not remove the secondary power piston subassembly from Holding Fixture, J-23101.

38. Pick up the primary power piston assembly and position the small end of the air valve return spring on the air valve so that it contacts the air valve retaining ring.

39. Fold the primary diaphragm away from the O.D. of the primary support plate.

40. Position the primary power piston on the tubular portion of the secondary power piston, making sure that the air valve return spring seats down over the raised center section of the secondary piston.

41. Grip the edge of the primary support plate, press down, and start the threads on the secondary power piston into the threaded portion of the primary power piston by rotating in a clockwise direction, Fig. 5-38.

42. Continue to tighten the primary power piston until it is securely attached to the secondary power piston.

43. Fold the primary diaphragm back into position on the primary support plate and pull the diaphragm O.D. over the formed lip of the housing divider. Check that the bead on the dia-

phragm is seated evenly around the complete circumference.

44. Wipe a thin film of silicone lubricant on the O.D. of the piston rod retainer. Insert the master cylinder piston rod retainer into the cavity in the secondary power piston so that the flat end bottoms against the rubber reaction disc in the bottom of the cavity.

45. Place the primary power piston seal in rear housing center hole so that the formed flange of the housing center hole fits into the groove of the primary power piston bearing. The thin lip of the bearing will protrude to the outside of the housing.

46. Coat the I.D. of the primary power piston seal with a thin film of silicone lubricant.

CAUTION: Excessive lubricant will contaminate and restrict silencer.

47. Mount Tool J-22884 in a vise and position the rear shell on the tool so that the studs fit in the holes provided in the tool.

48. Position the power piston return spring over the inset in the front shell.

49. Assemble the power piston to the rear shell by pressing the tube of the primary power piston through the rear housing seal. Press down until the housing divider seats in the rear shell and the primary power piston bottoms against the shell.

50. Place the piston rod retainer plate on the end of the power piston.

51. Hold the rear shell assembly (with mounting studs up) over the front shell. (Make sure that the piston rod retainer does not dislodge from the secondary power piston during this operation.) Position the rear shell so that when the tangs on the edge of the rear shell are locked in the slots on the edge of the front shell, the scribe marks on top of the shells will be in line.

52. Lower the rear shell assembly onto the front shell by tightening the hold down clamp. Check that the piston rod retainer goes through the center of the retainer plate on the power piston return spring. The retainer plate and power piston spring must seat in the depression in the face of the secondary power piston. Check that the bead on the O.D. of the secondary diaphragm is positioned between the edges of the shells.

53. Continue to tighten the clamp on the rear shell and fit the tangs, in the appropriate slots on the front shell.

54. Rotate the bar clockwise into the locked position and remove power head from Holding Fixture, J-22884.

55. Place the silencer in the closed end of the power head boot. Stretch the boot over the push rod and over the flange in the center of the rear housing and install boot retainer.

56. Place the power head assembly in a vise with the front shell facing up. Insert the master cylinder piston rod, flat end first, into the piston rod retainer.

57. Press down on the master cylinder piston rod to be sure it is properly seated.

NOTE: Remove the front housing seal to assure that no vacuum is in the power head while gaging.

58. Place Gage J-22647 over the piston rod in a position which will allow the gage to be slipped to the left or right without contacting the studs.

59. The center section of the gage has two levels. The piston rod should always contact the longer section (lower level) of the gage. The piston rod should never contact the shorter section (higher level) of the gage, Fig. 5-27. Move gage from side to side to check piston rod height.

60. Any variation beyond these two limits must

be compensated for by obtaining an adjustable piston rod from your servicing Parts Distribution Center and adjusting the self-locking screw to meet the gaging specifications.

61. Wipe a thin film of silicone lubricant on the I.D. of the front housing seal and position seal in the depression in the housing.

62. Install the master cylinder assembly on the front housing, positioning the cylinder on the mounting studs so that the top of the master cylinder reservoir is toward the scribe marks on the housings. Assemble the locknuts on the studs, (install metering valve mounting bracket under inboard locknut of 693 series units). Torque locknuts to 20 foot-pounds.

TORQUE SPECIFICATIONS—ELDORADO ONLY

Material Number	Application	Size	Foot Pounds
Special	Pipe Nut to Master Cylinder	1/2 -20 or 9/16-18	25 Max.
Special	All Other Brake Pipe Nuts	3/8 -24, 7/16-24, 1/2 -20	20 Max.
280M	Bearing Retainer/Splash Shield to Knuckle . .	3/8 -16	30
Special	Brake Hose to Brass Connectors	7/16-20	20 Max.
286M	Brake Backing Plate to Rear Axle Housing. .	3/8 -24	35
284M	Brake Unit to Cowl.	3/8 -24	13
286M	Brake Pedal Pivot Bolt	7/16-24	15
286M	Master Cylinder to Vacuum Power Head . .	3/8 -24	20
Special	Caliper to Support Plate Bolt	Special	30
Special	Piston Extension Screw	Special	90*
Special	Floating Piston Stop Bolt	10-24	30*
*Inch-Pounds			
NOTE: Refer to back of Manual, Page 16-1, for bolt and nut markings and steel classifications.			

SPECIFICATIONS

Item	693 Series Cars
Swept Braking Area (in square inches)	
Front	224
Rear	138
Lining Area (in square inches)	
Front	41.76
Rear	84
Wheel Cylinder Bore	
Front	2-15/16"
Rear	7/8"
Drums (inside diameter).	11.00"
Remachined Drum Diameter (maximum)	11.06"
Variations of Inside Drum Diameter (maximum)	
. . . . .	.002"
Run-Out of Inside Diameter. . . . .	.005"
Lateral Run-Out of Disc on Hub (Maximum) . . . . .	.008"
Flatness and Parallelism Between Frictional Surfaces of Disc . . . . .	.0005"
Lining Size (length, width, thickness in inches)	
Front	Inner Shoe 5.4 x 1.93 x .43
	Outer Shoe 5.4 x 1.93 x .41
Rear	
Primary	9.00 x 2.00 x .20
Secondary	12.00 x 2.00 x .29
Lining to Shoe Attachment Method	Rivets
Metering Valve	
Cut-in Pressure	115 psi
Blend Pressure	380 psi
Proportioning Valve	43% above 400 psi

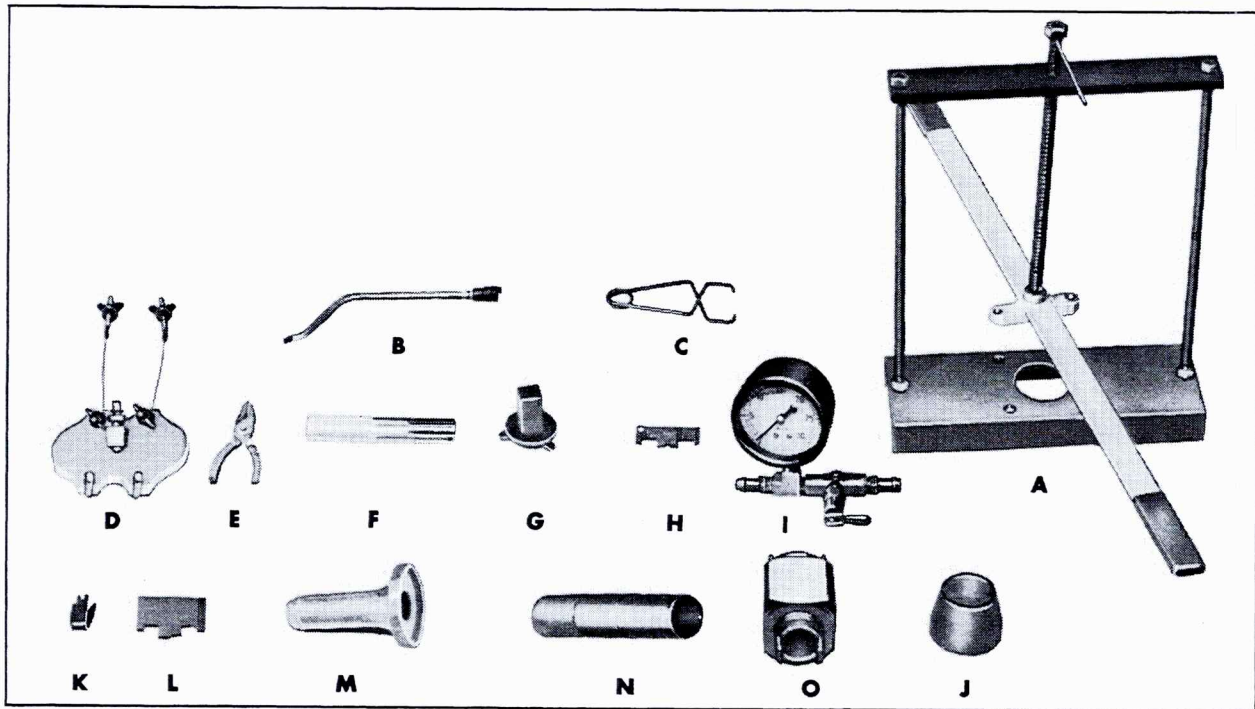


Fig. 5-47 Special Tools

SPECIAL TOOLS

Key	Tool No.	Name	Key	Tool No.	Name
A	J-22884	Power Unit Holding and Separating Fixture	G	J-21524	Power Piston Insert Wrench
B	J-8049	Brake Spring Remover and Installer	H	J-22647	Push Rod Height Gage
C	J-8002	Wheel Cylinder Clamp	I	J-23108	Leak Testing Adapter
D	J-22489-6	Bleeder Adapter Cover	J	J-23188	Seal Protector
E	J-22484-12	Bleeder Adapter Cover Cables	K	J-22742-01	Metering Valve Bleeder Retainer
F	J-4880	Snap Ring Pliers	L	J-23325	Reaction Piston Height Gage
	J-21601	Control Valve Installer	M	J-22904	Boot Installer
			N	J-23175	Control Valve Retainer Installer
			O	J-23101	Power Piston Holding Fixture